



PATENT

THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant :	Jeffrey S. Haas et al	Docket No. :	IL-11088
Serial No. :	10/788,558	Art Unit :	1743
Filed :	02/26/2004	Examiner :	Samuel P. Siefke
For :	EXPLOSIVES TESTER		

DECLARATION UNDER 37 CFR §1.132

Declaration by Eddie E. Scott

Commissioner of Patents and Trademarks  
Alexandria, VA 22313-1450

Dear Sir:

I, Eddie E. Scott, hereby declare that:

(1). I am a citizen of the United States and a resident of Danville, California.

(2). My education includes: Bachelor of Science Degree, University of Wyoming; Master of Science Degree, University of Texas at Dallas; Juris Doctor Degree, University of Wyoming; Patent Office Academy, Basic and Advanced, United States Patent and Trademark Office, Washington, D.C.

(3). In the Office Action mailed May 16, 2007, in the subject application, claims 1-24 were rejected under 35 U.S.C. §103(a) as being unpatentable over the cited references.

(4). I am employed by the University of California at the Lawrence Livermore National Laboratory as Assistant Laboratory Counsel and I have been employed by the University of California at the Lawrence Livermore National Laboratory from May 1, 1999 to the present.

(5). I am empowered to act on behalf of the owner of the subject application, The Regents of the University of California, and my responsibilities as Assistant Laboratory Counsel include the legal aspects of patent license agreements, invention development, invention commercialization, and patent application preparation and prosecution.

(6). The publications described below state that the explosives detector called the Easy Livermore Inspection Test for Explosives or ELITE has been licensed to Field Forensics Inc. Copies of the publications are attached.

A. The May 4, 2006 issue of the *Valley Times* newspaper states, "The lab has licensed the technology to Field Forensics Inc. of St. Petersburg, Fla."

B. The May 4, 2006 News Release "Screening tool to help detect explosives nets technology transfer award for LLNL researchers" by the Lawrence Livermore National Laboratory states, "The technology has been licensed to Field Forensics Inc., a St. Petersburg, Fla., company, and went on the market last October."

C. The May 12, 2006 article "New screening tool helps to detect explosives" states, "The technology has been licensed to Field Forensics Inc., a St. Petersburg, Fla., company, and went on the market last October."

D. The June/July issue of *Innovation: America's Journal of Technology Commercialization* states, "Field Forensics, Inc. responded to a Federal Business Opportunities announcement of the ELITE licensing opportunity and was chosen as the licensee."

(7). I have reviewed the license agreement between The Regents of the University of California and Field Forensics Inc. of St. Petersburg, Florida. I confirm that the explosives detector called the Easy Livermore Inspection Test

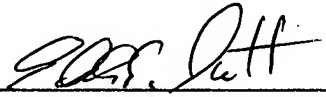
for Explosives or ELITE has been licensed to Field Forensics Inc. One of the inventions licensed by the license agreement is Record of Invention IL-11088. The subject patent application IL-11088 is a patent application based upon Record of Invention IL-11088 and the subject patent application IL-11088 is one of the patent applications licensed to Field Forensics Inc. under the license agreement.

(8). The Easy Livermore Inspection Test for Explosives or ELITE technology that includes the invention of claims 1-24 of the subject application has: (A) won a 2006 R&D 100 Award and (B) won a Federal Laboratory Consortium for Technology Transfer (FLC) Award for Excellence in Technology Transfer. The publications described below provide information about the 2006 R&D 100 Award and the Federal Laboratory Consortium for Technology Transfer (FLC) Award for the Easy Livermore Inspection Test for Explosives or ELITE technology that includes the subject application and the invention of claims 1-24 of the subject application. Copies of the publications are attached.

A. The article "Pocket-sized Test Detects Trace Explosives," in the October 2006 issue of Science & Technology Review (S&TR) contains the following statements: "The E.L.I.T.E. card technology was developed by a team of scientists and engineers from the Laboratory's Forensic Science Center (FSC) and Center for Energetic Materials. Led by FSC deputy director John Reynolds, the team won a 2006 R&D 100 Award for the new technology."

B. The article "FLC's Tech Transfer Award Winners" in the June/July issue of Innovation: America's Journal of Technology Commercialization" contains the following statements: "More than 700 laboratories and research centers—representing almost all federal departments and agencies—conduct over \$100 billion in research and development annually and employ more than 100,000 scientists and engineers. The Awards for Excellence in Technology Transfer are presented each year to FLC member laboratories and their partners for successfully transferring federally developed technologies. "Lawrence Livermore National Laboratory ELITE: Easy Livermore Inspection Tester for Explosives Summary: A disposable, portable, highly accurate explosives detector. The ELITE detection card is highly sensitive to more than 30 explosives, making it one of the most effective detection systems available."

(8). I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: August 8, 2007        
(Signature)      Declarant:      Eddie E. Scott

**Valley Times**  
**May 04, 2006**  
**Also appeared San Jose Mercury News**

**Area lab creates small, easy explosives-detection device**

**Livermore Laboratory's credit card-sized tool is in high demand from military, police officers**

*Betsy Mason*

**Lawrence Livermore Laboratory** has made explosives detection easier with a new credit-card sized kit that is cheap, easy and works in just minutes.

With terrorism fears running high since the Sept 11, 2001 terrorist attacks, detecting explosives is an even bigger priority for law enforcement and military personnel. Building on years of research with explosives detection in a laboratory setting, a team led by Livermore chemist John Reynolds grouped existing technology into a compact, stable package that could easily fit into the glove box of a police cruiser or a soldier's field pack.

The new detector is just two inches by three inches and slightly thicker than a credit card. Each kit will cost around \$25 and can generate results from one test in between one and four minutes.

The lab has licensed the technology to Field Forensics Inc. of St. Petersburg, Fla. On the market since October, customers include the U.S. Army and Canadian and Australian police. The company has pending orders from federal and state police agencies and from nuclear power plants.

"We have been talking with the airport authorities and they're quite interested in the technology," Reynolds said. "So I expect we'll see it in airports soon."

The new kit is as sensitive and reliable as the explosives-screening machines in major airports, but it is much less expensive and faster and easier to use.

The Lawrence Livermore team had military applications in mind when its members developed the kit. The ability to hunt down bomb makers in Iraq is critical to U.S. troops, they said.

"We think this will play an integral role," said Reynolds. "If you could catch them further up in the chain, like where the bombs are made, you'd actually be able to mitigate more attacks."

The kit can detect more than 30 different explosives. It contains a swipe that is used to wipe a suspect surface and then be re-inserted into the kit. A tiny glass vial full of chemicals is then broken inside the card, and if TNT is present, the swipe will change color. If there is no reaction, a second vial can be broken that will detect other types of explosives.

The new detector is called the Easy Livermore Inspection Test for Explosives, or ELITE.

The lab's researchers on the ELITE project were honored Wednesday night with a Federal Laboratory Consortium award for excellence in technology transfer that was presented during an awards ceremony in Minneapolis.

## Lawrence Livermore National Laboratory

### News Release

Contact: Steve Wampler  
Phone: (925) 423-3107  
E-mail: wampler1@llnl.gov

FOR IMMEDIATE RELEASE  
May 4, 2006  
NR-06-05-02

### Screening tool to help detect explosives nets technology transfer award for LLNL researchers

LIVERMORE, Calif. — Airport screeners, law enforcement and military personnel and others have a new ally in the war against terrorism – a portable, sensitive and accurate explosives detector developed by Lawrence Livermore National Laboratory researchers.

The new explosives detector, called the Easy Livermore Inspection Test for Explosives, or ELITE, is highly sensitive to more than 30 different explosives, making it one of the most effective explosive detection systems available, said John Reynolds, who led the technology's development and is the deputy director of LLNL's Forensic Science Center.

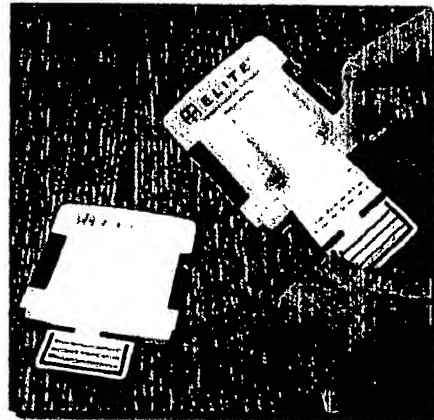
"Our goal is to develop new technology or take existing technology, make it better, and then adapt it for use in the field," Reynolds said.

Using the ELITE card, airport screeners, border patrol agents, security agents, first responders, police and military personnel and others can secure real-time analysis – within the space of one to four minutes – whether explosives are present, according to Reynolds.

The ELITE card was honored last night with a Federal Laboratory Consortium (FLC) award for excellence in technology transfer, presented to LLNL researchers during an awards dinner at the Minneapolis Marriott City Center.

The technology has been licensed to Field Forensics Inc., a St. Petersburg, Fla., company, and went on the market last October.

Already, the firm has picked up a host of customers, including the U.S. Army, the Royal Canadian Mounted Police, the Ontario Provincial Police, the Canada Air Marshals, the Queensland Police from Australia and others, said Field Forensics President Craig Johnson.



Jacqueline McBride/LLNL

The LLNL-developed ELITE explosives detector is designed for one-time use and can be disposed of as regular (non-hazardous) waste. Several of the devices can fit easily into a shirt pocket and can be used, for example, on vehicle door handles during routine traffic stops, on surfaces and door handles of suspicious parked vehicles, or on suspicious packages. The sample is tabbed for ease of handling and to allow recording of date, time, and sample location information.

Orders also are pending from several military agencies, federal and state police agencies and some commercial nuclear power plants, Johnson said.

"When it was announced that the ELITE explosives detection technology was going to be made available for licensing, we jumped at the opportunity," Johnson said. "ELITE technology is exactly that which our customers have been telling us they need: it's self-contained, small, light, disposable, easy to operate and inexpensive."

Reynolds echoes Johnson's points about the ELITE card's advantages, noting the technology is light (weighing a fraction of an ounce), small (the size of a 2-inch by 3-inch index card), inexpensive (costing less than \$25, substantially less in higher quantities) and stable (with a shelf life of about two years).

"It gives you a chance to detect explosives faster, cheaper and easier," Reynolds said. "That allows more law enforcement, military, airport security and others to have a better chance to catch the bad guys."

In Reynolds' view, the ELITE card could provide an important assist to the U.S. military in Iraq and on other fronts. "In Iraq, it could be used for finding bomb-makers, vehicles used to transport explosives or to find anyone in the chain of making improvised explosive devices.

"With great demand for travel in the industrial world, there is an increasing need for safe transportation within the United States and overseas," Reynolds said. "Significant issues involving explosives detection are cost, sensitivity and convenience. The ELITE detection alleviates all these concerns by providing a fast, reliable and convenient system that is easy to use."

To use the ELITE detection card, the suspect surface – whether hands, a vehicle or luggage – is wiped with a swipe. The swipe is replaced into the card and a small glass vial, or ampoule, is broken. If TNT-based explosive materials are present, the swipe will change color to indicate a positive reading. If the swab remains colorless and explosives are still suspected of being present, a second ampoule is broken, again looking for a color change that would indicate the presence of other types of explosives.

Development of the ELITE technology was achieved by a team of scientists from the Lab's Forensic Science Center, in partnership with LLNL's Energetic Materials Center, under research grants sponsored by the Department of Energy and the National Nuclear Security Administration. The work started in October 2003 and cost about \$1.5 million.

The Federal Laboratory Consortium for Technology Transfer (FLC) is a nationwide network of federal laboratories that provides the forum to develop strategies and opportunities for linking the laboratory mission technologies and expertise with the marketplace.

Organized in 1974 and formally chartered by the Federal Technology Transfer Act of 1986, the FLC consists of more than 700 major federal laboratories and centers and their parent departments and agencies.

Founded in 1952, Lawrence Livermore National Laboratory has a mission to ensure national security and to apply science and technology to the important issues of our time. Lawrence Livermore National Laboratory is managed by the University of California for the U.S. Department of Energy's National Nuclear Security Administration.

**More Information:**

- LLNL's Public Affairs Office ([www.llnl.gov/pao/](http://www.llnl.gov/pao/))
- LLNL's Forensic Science Center (<http://www-cms.llnl.gov/about/fsc.html>)
- "Forensic Science Center Maximizes the Tiniest Clue"  
*Science & Technology Review*, April 2002 ([www.llnl.gov/str/April02/Andresen.html](http://www.llnl.gov/str/April02/Andresen.html))

UCRL-WEB-206911



Lawrence Livermore National Laboratory  
7000 East Avenue • Livermore, CA 94550

May 5, 2006

Operated by the University of California for the  
Department of Energy's National Nuclear Security  
Administration



## SCIENCE NEWS

## New screening tool helps to detect explosives

By Stephen Wampler  
Newswatch staff writer

**A**irport screeners, military personnel and others have a new ally in the war against terrorism — a portable, sensitive and accurate explosives detector developed by Lawrence Livermore National Laboratory researchers.

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"Our goal is to develop new technology or take existing technology, make it better, and then adapt it for use in the field," Reynolds said.

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In Reynolds' view, the ELITE card could provide an important assist to the U.S. military in Iraq — and on other fronts. "In Iraq, it could be used for finding bomb-makers, vehicles used to transport explosives or to find anyone in the chain



JACQUELINE McBRIDE/NEWLINE

Among the key developers of the ELITE explosive screening technology are (left to right): Del Eckels, John Reynolds and Peter Nunes, all of the Lab's Forensic Science Center. They are shown with some of the early ELITE prototypes and the current card version, which is resting in front on the table.

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Development of the ELITE technology was achieved by a team of scientists from the Lab's Forensic Science Center, in partnership with LLNL's Energetic Materials Center, under research grants sponsored by the Department of Energy and the National Nuclear Security Administration. The work started in October 2003 and cost about \$1.5 million.

In addition to Reynolds, members of the team who played important roles in the development of ELITE were: engineer Del Eckels, chemists Peter Nunes, Rich Whipple, Phil Pagoria, Marina Chiarappa-Zucca and Randy Simpson, who is also the director of the Lab's Energetic Materials Center.

"We tried many different materials for ELITE for compatibility and durability before we found the right combination," Eckels said. "Our ultimate aim was to make something as small, disposable, inexpensive and easy to use as possible."

In the process of developing ELITE, Eckels produced five generations of prototypes, with one of the last ones being a small metal instrument about the size of two butter cubes, before producing the ELITE card.

"We had to adapt the existing chemistry into a new configuration to meet the needs of ELITE — a long shelf life, sensitivity and compatibility with materials," Reynolds explained.

The Federal Laboratory Consortium for Technology Transfer (FLC) is a nationwide network of federal laboratories that provides the forum to develop strategies and opportunities for linking the laboratory mission technologies and expertise with the marketplace.

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## Lab technology commercialization success not just for ELITE

In addition to the Easy Livermore Inspection Test for Explosives (ELITE), scientists and engineers at the Lab's Forensic Science Center (FSC) have developed other technologies that have been licensed and commercialized.

One such technology is a portable Gas Chromatograph-Mass Spectrometer (GC-MS) unit that was licensed in 2002 to Constellation Technology, a firm located in the Tampa Bay area of Florida.

The portable unit performs the same functions as laboratory benchtop GC-MS equipment — but in a 70-pound, transportable package about the size of an ice chest.

"The advantage of this technology is that while GC-MS units are typically a laboratory analytical tool, we've essentially taken it from the laboratory into the field," said FSC chemist Peter Nunes, who oversees this technology transfer effort.

With a portable GC-MS unit, researchers do not have to transport a sample back to the laboratory, allowing analysis in the field and permitting a sample run to be completed in 20 to 30 minutes, Nunes said.

In the past, Livermore scientists have been deployed to

support the California National Guard with the portable GC-MS system at the 2003 World Series and the Democratic National Convention to provide rapid chemical analysis in case of any terrorist incidents.

The work to produce a portable GC-MS system was undertaken by engineers Del Eckels, Doug Howard and James Wong and three former FSC scientists who have retired.

Another FSC technology that has been licensed is a field-portable Solid Phase MicroExtraction (SPME), or chemical sponge, that was licensed to Field Forensics of St. Petersburg, Fla.

SPME is a chemical analysis technique that was previously limited to labs because of its fragility. LLNL scientists made the technology more robust, so it could be used in the field.

"SPME permits the absorption of volatile organic chemicals and allows them to be directly injected into a GC-MS system without any sample preparation, which is a real time-saver," Nunes said.

The capability of using SPME in the field was developed by Nunes, Fred Kelly and Brim Andresen, who has retired from LLNL.

— STEPHEN WAMPLER

## ON THE COVER

Once a swipe from a Lab-developed explosives screening technology is exposed to explosives, replaced in its card and a glass vial is popped, the swipe changes color to indicate the presence of explosives.



# **innovation:**

**AMERICA'S JOURNAL OF  
TECHNOLOGY COMMERCIALIZATION**

## **FLC's Tech Transfer Award Winners**

June/July 2006

More than 700 laboratories and research centers—representing almost all federal departments and agencies—conduct over \$100 billion in research and development annually and employ more than 100,000 scientists and engineers. The Awards for Excellence in Technology Transfer are presented each year to FLC member laboratories and their partners for successfully transferring federally developed technologies.

Following are those recognized at this year's conference held in May in Minneapolis.

### **Department of Agriculture**

#### **•Agricultural Research Service, Mid South Area**

Vaccines for the prevention of two major catfish diseases.

Summary: The modified live vaccine team demonstrated exceptional creativity in the invention and transfer of the first U.S. modified live vaccines that protect channel catfish from enteric septicemia and columnaris, two major diseases of U.S. farm raised catfish. Both diseases together cost the U.S. catfish industry \$50-70 million annually. The modified live vaccines are administered by bath immersion, a non-stressful and inexpensive process, to large numbers of young fish and provide life-long protection.

Team: Phillip H. Klesius, Joyce J. Evans and Craig A. Shoemaker

Transfer: Both vaccines (AQUAVAC-COL™ and AQUAVAC-ESCT™) were developed under a CRADA with Intervet, Inc., and exclusively licensed to Intervet.

#### **•Agricultural Research Service, South Atlantic Area**

A fertilizer alleviating nickel deficiencies.

Summary: The new Nickel Plus™ associated technology has cured significant plant disorders and diseases having a beneficial impact of millions of dollars. Additionally, evidence indicates improving nickel nutrition may also serve to improve environmental quality because it reduces the use of fungicides and nitrogen fertilizers for certain crops.

Team: Bruce W. Wood

Transfer: A cooperative interaction was initiated to jointly develop a commercial nickel fertilizer product (Nickel Plus™), and a new company (NIPAN, LLC) was formed. NIPAN, the co-owner of the patent, is negotiating an exclusive license to ARS' interest in the technology for correcting nickel deficiency in plants.

### **Department of Defense—Army**

#### **• Corps of Engineers, Engineer Research and Development Center, Construction Engineering Research Laboratory** **Electro-Osmotic Pulse (EOP), for the control of moisture in below-grade concrete structures.**

Summary: EOP eliminates moisture in below-grade structures, preventing the occurrence of mold, mildew, bacteria, corrosion, and standing water. It uses the concrete itself as the waterproofing agent by exploiting the fundamental

properties of electro-osmosis. EOP is better, faster and 40 percent less costly to install than conventional moisture control solutions.

Team: Orange S. Marshall, Michael K. McInerney, Sean Morefield and Vincent F. Hock

Transfer: In 2004, a new CRADA was implemented with industry partner, Drytronic. The parent company created the spin off, OsmoTech, to maximize EOP commercialization. The novel inter-relationship between the ERDC, Drytronic and its licensee OsmoTech has grown client application potential to include projects such as highway construction and tunnels.

- Edgewood Chemical Biological Center

Enzyme-based decontamination technology for organophosphorus nerve agents and pesticides.

Summary: This technology simplifies and improves the process of decontaminating a class of highly toxic chemicals, including nerve agents. The ECBC technology is non-toxic, non-corrosive, and environmentally safe.

While initially intended for decontaminating equipment, facilities, and large areas, the enzymes could potentially be used in shower systems for decontaminating personnel and casualties.

Team: Joseph J. DeFrank, Tu-Chen Cheng, Vipin K. Rastogi and Christopher S. Penet

Transfer: Genencor International, Inc., agreed to license the technology and is now successfully producing the licensed enzymatic decontamination technology under the trademark DEFENZ™. Companies that produce and sell fire-fighting foams and sprays and other matrices are purchasing this product.

- Institute of Surgical Research

Special Medical Emergency Evacuation Device (SMEED).

Summary: A patent-protected metal framework that attaches to evacuation litters and holds individual pieces of medical equipment needed for optimal patient transport, lessening the discomfort of burn victims during medical transport. It eliminates the need to fasten uncomfortable equipment directly to patients and gives health care providers a clear view of any readout monitors on attached medical devices.

Team: Sgt. Eric Smeed (yes, that's Smeed!)

Transfer: The Army patented the device and in 2002 awarded a Small Business Innovation Research contract and exclusive license agreement to Impact Instrumentation Inc. of New Jersey. The company further developed the technology, manufacturing a commercial product now on the market.

## Department of Defense—Navy

- Naval Air Warfare Center Aircraft Division, Lakehurst

Liquid Atomizing Nozzle

Summary: A lightweight, non-clogging, inexpensive technology that does not require the extremely high operating pressures of standard fire suppression systems. It conserves water and minimizes consequential water damage and is a more environmentally safe method of fire suppression onboard aircraft. Smaller amounts of water can extinguish a fire more quickly, making it possible to carry water rather than environmentally harmful chemicals like halon, which is traditionally used in aircraft fire extinguishment systems.

Team: Joseph Wolfe

Transfer: Patented in 1996, the technology was transferred in 2001 via a partially exclusive license agreement to the aerospace supply company, International Aero Inc. of Burlington, Wash. The resulting commercial product, the Fine Water Mist System, awaits FAA approval for widespread aircraft use.

- Naval Air Warfare Center Aircraft Division, Patuxent River

Trivalent Chromium Processes (TCP).

Summary: A metal surface coating containing trivalent chromium sulfate that protects against corrosive environments, a significant improvement over the widely used, traditional but toxic hexavalent chromium process. The chemical solution minimizes corrosion of aluminum, zinc, and other substrates while it improves the bonding surface for paints.

Team: James L. Green, Michael J. Kane and Craig Matzdorf

Transfer: Under nonexclusive patent license agreements with several companies, the center has successfully transferred this important advance in metal finishing to widespread civilian use. Currently four licensees are in various stages of marketing TCP to consumers in the United States, Canada and Mexico.

•Naval Medical Center, San Diego

Treatment of noise-induced hearing loss through biologic mechanisms.

Summary: An orally administered antioxidant pharmaceutical product that will prevent, reduce, and in some cases even reverse acute noise-induced hearing loss. According to the Center for Disease Control, hearing loss costs the nation about \$56 billion a year.

Team: Richard Kopke and Michael Hoffer

Transfer: This technology has been successfully transferred to the private sector through an exclusive patent licensing agreement with American BioHealth Group (ABG). ABG has been on the fast track and one product based on this technology is already available to the public as a nonprescription nutraceutical known as “The Hearing Pill™.”

•Naval Undersea Warfare Center Division, Newport

Robust dimension reducing decision support tool for large, complex datasets.

Summary: The Data Extraction and Mining Software Tool (DEMIST) for large, complex data sets was developed and patented to support classification of targets for U.S. Navy sonar systems. DEMIST takes large, multi-dimensional datasets and reduces them dramatically in size to include only the relevant information needed for decision-making.

Team: Robert Lynch

Transfer: Under multiple CRADAs, DEMIST is being incorporated in software suites for credit scoring, consumer market targeting, chemical analysis, enterprise level risk management and decision support industries. Additional applications and licensing agreements are in process to apply DEMIST to problems associated with medical applications such as bioinformatics, pharmacogenomics and for homeland security-related data mining.

Department of Defense—Air Force

•Air Force Research Laboratory, Directed Energy Directorate

Low emission, high current density field emission cold cathode.

Summary: This cold-cathode technology can deliver high electron current densities using very low power, therefore allowing the systems into which they’re installed to operate at cool temperatures and be light in weight.

Team: Donald Shiffler

Transfer: The technology has been transferred to Fiore Industries, Albuquerque, through a licensing agreement. The technology has been further transferred to the private sector through CRADAs with companies that are developing X-ray tubes based on this cold cathode technology and has also been directly transferred through consultation and discussion to other federal labs, including Sandia National Laboratories.

•Air Force Research Laboratory, Human Effectiveness Directorate

The Attenuating Custom Communications Earpiece System (ACCES®).

Summary: The Attenuating Custom Communications Earpiece System (ACCES®), integrates specialized electronics and cabling into a custom-molded earplug that provides 40dB of mean noise reduction while providing clearly intelligible voice communication.

Team: John A. Hall

Transfer: Westone Laboratories, the tech transfer partner producing this state-of-the-art device, was recently awarded a General Services Administration contract. Even before gaining the GSA contract, ACCES had its inaugural commercial use in Spaceship One, the first private craft to fly more than 50 miles above the earth.

•Air Force Research Laboratory, Materials and Manufacturing Directorate  
Vascular Viewer™

Summary: A patent-protected viewing device that reveals blood vessels in the body under a broad range of lighting conditions. Medical personnel can use the invention to access blood vessels more quickly and accurately, even in extreme conditions such as on the battlefield or during trauma care.

Team: Robert Crane, Byron Edmonds, Walter Johnson and Charles Lovett

Transfer: The invention now is available as a commercial product—the Vascular Viewer—with impressive potential for saving lives, minimizing patient discomfort, and reducing health care costs. The Air Force awarded an exclusive license to a company to develop and market the technology, InfraRed Imaging Systems of Columbus, Ohio.

•Air Force Research Laboratory,  
Propulsion Directorate  
Silicon Carbide Schottky Diodes

Summary: This specialized semiconductor device is proven to reduce energy losses from conduction and switching, and for faster switching characteristics in high-speed electronic circuit applications.

Team: James Scofield

Transfer: In collaboration with Mississippi State University to incubate SemiSouth Laboratories under funding from the Ballistic Missile Defense Organization (now known as the Missile Defense Agency), this collaboration made Silicon Carbide fabrication practical for power devices. Also, a dual use science and technology agreement was implemented with manufacturer Cree, Inc., of Durham, N.C.

Department of Energy

•Argonne National Laboratory

Ultrananocrystalline Diamond (UNCD) coating technology for advanced multifunctional devices.

Summary: The coating technology captures many natural diamond properties in thin-film form and greatly surpasses other diamond film technologies with commercial potential.

Team: Orlando Auciellor and John A. Carlisle

Transfer: The UNCD thin-film technology was successfully transferred to an ANL-founded startup company, Advanced Diamond Technologies, Inc.

•Lawrence Livermore National Laboratory

ELITE: Easy Livermore Inspection Tester for Explosives

Summary: A disposable, portable, highly accurate explosives detector.

The ELITE detection card is highly sensitive to more than 30 explosives, making it one of the most effective detection systems available.

Team: John Reynolds, Ray Pierce, Peter Nunes, J. Del Eckels, Randall Simpson, Catherine Elizondo and Richard Whipple

Transfer: Field Forensics, Inc. responded to a Federal Business Opportunities announcement of the ELITE licensing opportunity and was chosen as the licensee.

•Los Alamos National Laboratory

PowerFactoRE—Reliability engineering toolkit for optimizing the manufacturing process.

Summary: A comprehensive approach to reducing operating costs and minimizing capital expenditures for manufacturing operations. PowerFactoRE enables manufacturers to predict, prevent, and reduce reliability losses, equipment failures, and repair downtime.

Team: Mike Hamada and Harry Martz

Transfer: Proctor & Gamble and LANL signed a CRADA to do reliability modeling using P&G data and Los Alamos expertise. Other manufacturers are realizing the same advantages P&G has enjoyed by licensing the PowerFactoRE toolkit from P&G and its marketing partners, BearingPoint and Zarpac, Inc.

•NNSA's Kansas City Plant

Improved method to separate and recover oil and plastic.

Summary: A new system for recycling plastic and oil that uses liquid and supercritical carbon dioxide to blast oil residue off of empty plastic motor oil bottles.

Team: George Bohnert, Thomas Hand, Gerald Woodburn, Edward Fuller, Charles Cook, Charles Long and Louis Mautino.

Transfer: The Kansas City Plant patented this process and licensed the technology to Itec Environmental Group, which used it to develop a plastics recycling system called the ECO2. Itec has been able to use this system to recycle not only motor oil bottles, but almost every other type of consumer plastic as well.

•Pacific Northwest National Laboratory

A breakthrough treatment for prostate cancer.

Summary: A powerful new brachytherapy seed that uses  $^{131}\text{Cs}$ , which has a low-energy x-ray that effectively provides a cancer-killing dose to a tumor in a short period of time.

Team: Larry R. Greenwood, Donald Segna, Mark K. Murphy, Jaquetta R. DesChane, Lane A. Bray, Deborah S. Coffey, David Swanberg, Chuck Z. Soderquist, Clay L. O'Laughlin and Garrett Brown.

Transfer: IsoRay, which became a publicly owned company in July 2005, started the effort to produce the seeds commercially using PNNL's Radiochemical Processing Laboratory in 2004 under a current agreement with PNNL.

■

Improving medical care and saving lives with bioactive thin-film coatings.

Summary: A first-ever, water-based process that allows calcium-phosphate thin-film coatings containing controlled-release bioactive therapeutic agents to be deposited on orthopedic devices and other medical implants, such as catheters and stents. This technology will play a major role in dramatically reducing post-surgical infections in implant recipients and wounded military personnel, and will greatly increase acceptance of artificial joints by the body.

Team: Allison A. Campbell and Eric R. Jurrus

Transfer: The technology was licensed in 2004 by Bacterin, which recently joined forces with the Department of Defense, receiving a \$1.4 million appropriation to coat metal rods and pins with the technology for use in the battlefield. In addition, Bacterin has forged new relationships with three medical device manufacturers—Baxter International, C.R. Bard, and Cook—that have agreed to use the unique coating on their products.

■

Self-assembled monolayers on mesoporous silica (SAMMS) technology for mercury source reduction

Summary: A technology that quickly and easily reduces or removes mercury content without creating hazardous waste or by-products, and can be disposed of as a non-hazardous waste.

Team: Richard Skaggs, Glen E. Fryxell, Eric C. Lund, Shas V. Mattigod, Raymond S. Addleman, James J. Toth and Thomas S. Zemanian

Transfer: The technology has been presented to appropriate audiences and PNNL has developed relationships with industry partners, including Steward Advanced Materials, Chevron (formerly Unocal), Molycorp and PECO.

■

Starlight information visualization system

Summary: Starlight is the only software that can integrate many different data types and formats, perform high-speed, high-efficiency analysis, and display the results graphically so that the relationships among the data and their implications can be quickly and easily understood.

Team: John S. Risch, John Pinto, Michelle Hart, Dennis McQuerry, Brian Kriztstein, Scott Dowson and Wes Hatley.  
Transfer: Between 2000 and 2005, nearly 40 licenses were issued to enterprises ranging from government offices to academia, from small competitive intelligence companies to large companies such as Toyota and Proctor & Gamble.

•Sandia National Laboratories

Robust, wide-range hydrogen sensor

Summary: The sensor offers both low-range and high-range hydrogen measurement capability on the same chip, virtually eliminating false readings and making it an ideal candidate for a variety of government and commercial applications.

Team: Paul Smith, Robert Hughes, Michael Knoll, Jose L. Rodriguez and Wayne T. Corbett

Transfer: H2scan Corporation of Valencia, Calif., has licensed the technology and through a formal CRADA has developed a small in situ sensor with the capability of detecting hydrogen concentrations between 10 parts per million and 100 percent. H2scan has three retail products in commercial use and has delivered sensors to over 200 government and industry customers, including a classified DOE plant in Idaho Falls.

■

SMART: Sensor for measurement and analysis of radiation transients system

Summary: This system uses detectors and software to distinguish between normally occurring radioactive materials and those that are potential signatures of terrorist activities. The system operates in real time and indicates the level of confidence (low, fair, high) that the material has been correctly identified.

Team: Dean Mitchell, Jerry D. Strother, Peter E. Havey, Gene A. Kallenbach and Brent A. Burdick

Transfer: Sandia licensed its FitToDB and PASSBY software technology to Thermo Electron Corporation in 2003 and its GADRAS-LT software to Thermo Electron the following year. Under a CRADA signed in 2005, Sandia and Thermo Electron are also collaborating on refinement of the software for large-scale commercial deployments in Thermo Electron's advanced spectroscopic portal system.

■

SUMMiT V™ Fabrication Process and SAMPLES™ Program

Summary: The Sandia Ultraplanar, Multilevel MEMS Technology (SUMMiT™) fabrication process is a MEMS batch fabrication process that uses conventional integrated circuit processing tools to achieve high volume, low cost MEMS production.

Team: Over 50 individuals.

Transfer: The SAMPLES™ program, which enable customers to develop their own innovative MEMS-based products by leveraging advanced design, fabrication (utilizing the baseline SUMMiT IV™ and V™ technologies), has generated 49 Work for Others agreements and over 75 software licenses related to the SUMMiT™ fabrication processes.

Department of Health and Human Services

• National Cancer Institute, National Institutes of Health

Kepivance: Improving the quality of life for cancer patients.

Summary: This invention describes the use of Palifermin, a recombinant human keratinocyte growth factor (KGF) that can be used to reduce the incidence and duration of oral mucositis (painful sores and ulcers in the lining of the mouth) in cancer patients.

Team: Jeffrey S. Rubin, Paul W. Finch and Stuart A. Aaronson

Transfer: Amgen was chosen as a commercial partner to develop a useful therapeutic with this molecule because it had worked with other growth factors such as PDGF and G-CSF. Convinced that KGF would fit well in Amgen's product development strategy, NIH granted them an exclusive license to the invention in 1992. It was approved by

the FDA in 2004 and sold under the brand name Kepivance.

## NASA

### John F. Kennedy Space Center

#### Emulsified zero-valent iron (EZVI)

Summary: A cost-effective technology for the in-situ treatment of dense non-aqueous phase liquids (DNAPL) source zone remediation and groundwater cleanup.

Team: Jacqueline W. Quinn, Debra R. Reinhart, Christian Clausen III and Cherie L. Geiger

Transfer: Kennedy Space Center signed five nonexclusive licenses with companies wanting to market and further develop EZVI.

### •Marshall Space Flight Center

#### High-strength, wear-resistant aluminum alloy

Summary: Originally developed by NASA as a high-performance piston alloy to help meet U.S. automotive legislation requiring low-exhaust emission, the substance offers the dramatic increase in tensile strength at elevated temperatures (from 450 to 650 °F) needed for many applications.

Team: Po-Shou Chen, Jonathan Lee and Sammy Nabors

Transfer: The technology was recently used in Bombardier Recreational Products' Evinrude product line to meet the unique requirements of a direct-injected two-stroke outboard engine with world-class emissions levels. An ideal low-cost material for cast automotive components, the innovative alloy is enabling engine manufacturers to make engines that produce more horsepower at lighter weights that emit less pollutants.

For more information, see [www.federallabs.org](http://www.federallabs.org).



# POCKET-SIZED TEST DETECTS

**S**ECURITY forces throughout the world need detection tools that can quickly and accurately locate small amounts of explosives. Technology developed by Lawrence Livermore will provide emergency response, law-enforcement, and military personnel


with an easy-to-use explosives detector small enough to carry in a shirt pocket. This technology, called E.L.I.T.E.<sup>TM</sup> (Easy Livermore Inspection Test for Explosives), is inexpensive and requires minimal training for deployment.

E.L.I.T.E. cards are particularly useful for screening vehicles, containers, and people for explosives residue. The 5- by 7.5-centimeter card weighs about an ounce, and test results are available immediately in the field. After a card has been used, it can be discarded without special handling.

The E.L.I.T.E. card technology was developed by a team of scientists and engineers from the Laboratory's Forensic Science Center (FSC) and Center for Energetic Materials. Led by FSC deputy director John Reynolds, the team won a 2006 R&D 100 Award for the new technology. The product, which also received a 2006 Excellence in Technology Transfer Award from the Federal Laboratory Consortium, is marketed by Field Forensics, Inc., of Florida. Since October 2005, when units became commercially available, Field Forensics has sold E.L.I.T.E. cards to many government agencies, including the Department of Homeland Security, New York State Police, Royal Canadian Mounted Police, and Queensland (Australia) Police.



The E.L.I.T.E.<sup>TM</sup> card is small enough to fit in a pocket, yet sensitive enough to detect trace amounts of up to 30 explosives.



Livermore members of the E.L.I.T.E.<sup>TM</sup> development team (from left to right): Randall Simpson, John Reynolds, J. Del Eckels, and Pete Nunes.

Lawrence Livermore National Laboratory

# TRACE EXPLOSIVES

## Inexpensive Cards with Built-In Simplicity

Each E.L.I.T.E. card is good for one test. To collect a sample, a user removes the swipe from the card, rubs it on a suspect area—a shoe, car door, or suitcase—and slides it back into the card. The user then ruptures two sealed ampoules that contain the developing chemicals. A few drops of the reagent flow onto the swipe through microchannels fabricated in the card's plastic case. Within a minute, an explosive trace, if present, will appear as a brightly colored spot on the white swipe.

The color and intensity of the spot indicate the type and concentration of the explosive found. Explosives generally show up as bright red or pink, so they are easy to distinguish from dirt and other stray substances. The chemical formulation used in E.L.I.T.E. cards can detect military and commercial explosives, such as C-4, Semtex, TNT, and derivatives, as well as inorganic explosives and propellants, such as ammonium nitrate and black powder. A used card requires no special handling and can be disposed of as regular waste.

The cost of detection technology is a critical issue for many security organizations, and E.L.I.T.E. delivers an affordable product. Cards cost \$10 to \$20 each; other commercially available screening systems can range from \$40 to \$7,500. But cost is not the only advantage. "We developed a reagent formulation with a dramatically improved shelf life," says Reynolds. "E.L.I.T.E. units have a much longer service life than comparable products." Similar screening products have an average shelf life of one year or less.

Once in service, these detection tools remain effective for one to four months. The E.L.I.T.E. reagents, however, have an indefinite shelf life and do not have to be replaced frequently.

The E.L.I.T.E. card also has lower detection limits than other screening products and can detect more than

30 types of explosives and propellants. In addition, reagents are self-contained in each card, so users are never exposed to these chemicals. Other detection technologies typically store reagents in separate bottles, and users must spray the formula onto a swipe or otherwise apply it by hand. This approach not only exposes users to chemicals but also can be difficult to use in inclement weather.

Reynolds notes that other explosives detection kits can be cumbersome or require users to follow complicated procedures. "The E.L.I.T.E. card solves this problem, too," he says. "Instructions are printed right on the card, so user error is largely eliminated. Plus the engineered design dispenses the proper amount of chemicals each time."

## Potential to Save Lives

E.L.I.T.E. cards operate effectively in harsh environments, so the technology could be adapted for military use, such as to screen materials in combat zones. Other applications include border inspections, airport and transit security, and decontamination verification.

The cards' potential to stem terrorism is also clear. "Explosives will continue to be a terrorist's weapon of choice as long as they are available in a usable form," says Reynolds. "E.L.I.T.E. cards provide security personnel with a fast, effective method to detect explosives and deter their use. These sensitive, robust explosives detectors offer an enormous potential for saving the lives of civilians and military and law-enforcement personnel."

—Ann Parker

**Key Words:** Easy Livermore Inspection Test for Explosives (E.L.I.T.E.<sup>TM</sup>) card, explosives testing, R&D 100 Award.

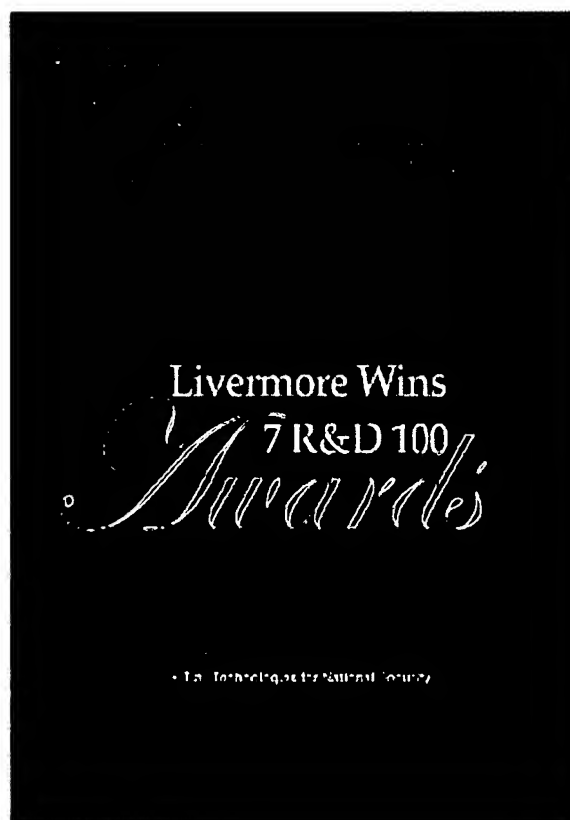
**For further information contact John Reynolds (925) 422-6028 (reynolds3@llnl.gov).**



Lawrence Livermore National Laboratory

## About the Cover

Laboratory researchers captured seven R&D 100 awards in *R&D Magazine's* annual competition for the top 100 industrial innovations worldwide. Highlights beginning on p. 4 describe the award-winning technologies: a pocket-sized explosives detector, a highly precise radiation detector, an airborne wide-area surveillance system, an improved wavelength converter for high-average-power lasers, data-mining software, an application to provide programming language interoperability, and an interferometer that improves the search for distant planets. Since 1978, Livermore researchers have received 113 R&D 100 awards. The R&D 100 logo on p. 1 is reprinted courtesy of *R&D Magazine*.



Cover design: Amy Henke

# **Explosives Detection**

## **The Three Sectors of Society That Rely on Explosives Detection**

Category: [Explosives Detection](#) — kevindark @ 7:25 pm

**08/23/2006**

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After an explosion one does not need an expert to conduct explosives detection. For security personnel, however, the real trick is finding a way to detect an explosives device before its detonation leads to injuries or fatalities. Three different sectors have had reason to hire large numbers of security personnel. Three different sectors of society have reason to purchase equipment for explosives detection. The following article takes a closer look at the nature of the security needs in those three sectors. It also mentions how new and improved detection devices can alleviate the threat posed by many types of dangers.

Explosives, such as those in firecrackers, have been around for quite some time. The need for detection of those who possess such explosives has recently created an entire new industry. The equipment produced by manufacturers within that industry has been purchased by groups in three different sectors of modern-day society.

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Those involved with transportation security represent one group that has come to rely on explosives detection. At one time detection of explosives relied exclusively on the use of metal detectors. Present-day suicide bombers, however, have forced those in transportation security to look beyond the ability to detect metallic devices. Present-day explosives detection must be able to pick-up those who have non-metallic devices on their person.

One device that can do just that is the Sentinel II, a device used at portals in airports. The Sentinel II causes a flow of air to pass over each passenger. The air removes any loose explosives particles from the skin or clothing. The sample obtained from each passenger needs to be analyzed for explosives.

The members of the military occupy the second sector of society that has come to rely on explosives detection. The manufacturers of the detection devices for the military have focused their efforts on the miniaturization of existing devices. They have now developed collective protection alarms that are easy to move from place to place. Such alarms offer added protection to military vehicles, small boats with military personnel and command bunkers.

The third sector of society that has started to use explosives detection contains the persons involved with facilities security. This represents a large sector, one with many possible targets for explosive devices. Some of the facilities can be described as vital utilities. Water treatment plants and electrical generators powered by nuclear reactors are two such vital utilities. Sports centers and shopping malls are also facilities that have been mentioned as "soft targets" for explosives experts.

At all of those facilities the security personnel have three major concerns. One concern focuses on possible contamination in the heating, ventilation or air conditioning systems. A second concern considers the possible contamination of the water supply. The third concern brings-up the need for explosives detection. That is the fear that someone could plant a bomb inside of any such facility.

The above information has failed to mention one further possible treat to the occupants in any facility. It is also a threat that could disrupt the functioning of a transportation system. That unmentioned threat received much media attention in the mid 1990's. At that time, a terrorist released a toxic gas into a Japanese subway.

Hopefully the latest developments in explosives detection will lead to the development of ways to deter a repeat of such a frightening action.

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## **HomelandDefenseStocks.com Reports: As Terrorist Attacks Continue, Need for Explosives Detection System Technology Surges**

Market Wire, July, 2005

www.HomelandDefenseStocks.com (HDS) an investor news portal for the homeland defense and security sector, reports on the need for explosives detection system technologies as threats of terrorist attacks continue. Companies working towards bomb detection technology include L-3 Communications Security and Detection Systems, Inc. (NYSE: LLL), the world's leading supplier of X-ray security screening systems; Markland Technologies (OTC BB: MRKL) a defense and homeland security company transforming advanced laboratory technology into real-world products such as next-generation electronic imaging and other detection solutions; Sniffex (OTC: SNFX) manufacturer of a pocket-sized, hand held explosives detection device; and Law Enforcement Associates Corporation (OTC BB: LENF), a manufacturer of a diverse line of undercover surveillance and detection products.

---

## **ELITE Forensic Explosive Material Detection Device for Law Enforcement, Commercial, Military, Airline and Homeland Security**

**Field Forensics Inc. (FFI)** manufactures innovative and reliable, disposable explosives and gun shot residue detection kits. FFI also manufactures SPME (Solid Phase Micro-Extraction) technology products for field sampling and lab analysis of explosives, drugs, accelerants, and toxins.

**FFI** is dedicated to producing practical and robust detection devices for use in homeland security and law enforcement.

**E.L.I.T.E.™** is a new technology for explosives and gun shot residue detection manufactured and distributed internationally by **FFI**.

**E.L.I.T.E.™ Model EL100** is a simple, quick, and cost-effective, explosives detection kit. **E.L.I.T.E.™ Model EL100** detects PETN, RDX, and HMX, ammonium nitrate and more than forty other compounds used in commercial, military, and improvised explosives.

### **E.L.I.T.E.™ Model EL100 Explosive Detection Kit**

Quick – results in 90 seconds or less

Simple – designed for use by non-specialists

Tough – long life in extreme environmental conditions

Sensitive – up to 10,000% more sensitive than other kits

Field-tested and effective, **E.L.I.T.E.** is currently in use with many military, law enforcement, homeland security and commercial security groups.

**E.L.I.T.E.™ Model EL100** is the winner of the R&D 100 Award for 2006 and is also a winner of the US Federal Laboratory Consortium's



**R & D 100  
AWARD WINNER  
2006**

Excellence in Technology Transfer Award.

**FFI** has offices and agents worldwide including the United States, Canada, Hong Kong, Singapore, Japan, Australia, Egypt, United Arab Emirates, Saudi Arabia, the United Kingdom, Spain, Scandinavia and South America.

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## **Explosive Detection Device for Commercial Protection, Military Security and Homeland Defense**

### **Affordable, Effective, Reliable, Ultra-Portable & Disposable**

For several years Field Forensics, Inc. (FFI), in response to the demands of its commercial security, homeland defense and military clients, had been searching for the explosives detection technology that could be universally deployed in the fight against terrorism.

In response to these demands, FFI recently introduced the E.L.I.T.E.<sup>™</sup>, Model EL100, Explosives Detection Kit. Developed in cooperation with one of the USA's top national research laboratories, the EL100 finally allows a pocket-sized, disposable, low-cost, reliable, robust, and easy-to-use explosives detection device. Field Forensics, Inc. has now made E.L.I.T.E.<sup>™</sup> Technology commercially available. The EL100 exceeds existing kits in:

- 1.Detection Capability:** detects 50% more types of explosives
- 2.Sensitivity:** is up to 10,000% more sensitive
- 3.Reliability:** has at least twice the shelf life of many existing kits
- 4.Ease of Use:** there are no bottles or vials – It is NOT a miniature chemistry lab



**R & D 100**  
**AWARD WINNER**  
**2006**

**The explosives detection process with the E.L.I.T.E.<sup>™</sup> is quick:**

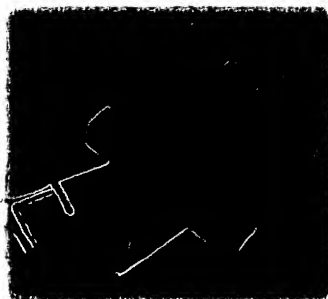
**Step 1. Remove swab**



**Step 2. Rub surface**



**Step 3. Re-insert swab**



**Step 4. Snap 'A'**



**Step 5. High-color result**



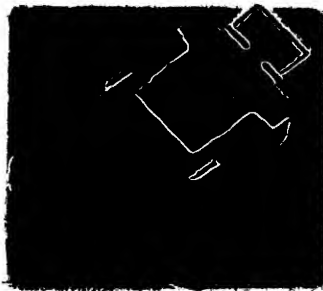
While sensing instruments such as “sniffers” and other devices have their place, they are simply too expensive, too cumbersome, and sometimes too unreliable to be fielded in significant numbers. Also, since many explosives do not have much of a vapor signature, sniffers will have limited utility in detecting them.

The E.L.I.T.E.™ EL100 reliably detects the presence of explosives and propellants. It is self-contained, with only a small optional heating system such as a butane lighter or battery-powered heater. To collect a sample, the EL100 swab is rubbed on the suspect area, object or person and then placed back into the card for testing. Two sealed ampoules containing very small amounts of chemicals are ruptured in a specific order. These chemicals create a very visible color change in the presence of a broad range of military, commercial and inorganic explosives and propellants. The entire test takes less than 90 seconds.

**Some examples of positives for TNT, Tetryl, 2,6 DNT, RDX and ANFO (left to right):**



The EL100 detects dozens of explosives – military, commercial, and those made by would-be terrorists.



#### **Model EL100-BPH**

**Battery Powered Heater** – portable heating device for EL100. The portable heater operates on NIMH rechargeable batteries and is designed to operate for an eight-hour shift of normal, intermittent usage. It extends the range of the EL100 and improves sensitivity.



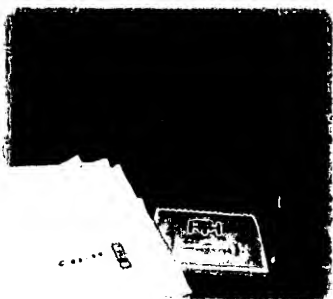
#### **Model EL100-BLH**

**Heating Jig** – the heating jig is designed for use with an open flame such as a cigarette lighter of some sort. The jig folds on itself for easy storage. It extends the range of the EL100 and improves sensitivity.



### **Model EL101 Field Kit**

**Field Kit** – hard-sided field kit includes ten EL100 kits, one each EL100-BPH and EL100-BLH, EL100-FG Field Guide (weatherproof).



### **Model EL102 Field Kit**

**Field Kit** – soft-sided field kit includes ten EL100 kits, one each EL100-BPH and EL100-BLH, EL100-FG Field Guide (weatherproof).

E.L.I.T.E.™ is made in the USA. Patents Pending.

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant :	Jeffery S. Haas et al	Docket No. :	IL-11088
Serial No. :	10/788,558	Art Unit :	1743
Filed :	02/26/2004	Examiner :	Samuel P. Siefke
For :	EXPLOSIVES TESTER		

DECLARATION UNDER 37 CFR § 1.132

Declaration by Catherine Elizondo

Commissioner of Patents and Trademarks  
Alexandria, VA 22313-1450

Dear Sir:

I, Catherine Elizondo, hereby declare that:

(1). I am a citizen of the United States and a resident of Brentwood, California.

(2). I am employed by the University of California at the Lawrence Livermore National Laboratory as a Business Development Executive in the Industrial Partnerships and Commercialization office and I have been employed by the University of California at the Lawrence Livermore National Laboratory from 1998 to the present.

(3). The publications described below state that the explosives detector called the Easy Livermore Inspection Test for Explosives or ELITE has been licensed to Field Forensics Inc. Copies of the publications are attached.

A. The May 4, 2006 issue of the *Valley Times* newspaper states, "The lab has licensed the technology to Field Forensics Inc. of St. Petersburg, Fla."

B. The May 4, 2006 News Release "Screening tool to help detect explosives nets technology transfer award for LLNL researchers" by the Lawrence Livermore National Laboratory states, "The technology has been licensed to Field Forensics Inc., a St. Petersburg, Fla., company, and went on the market last October."


C. The May 12, 2006 article "New screening tool helps to detect explosives" states, "The technology has been licensed to Field Forensics Inc., a St. Petersburg, Fla., company, and went on the market last October."

D. The June/July issue of Innovation: America's Journal of Technology Commercialization states, "Field Forensics, Inc. responded to a Federal Business Opportunities announcement of the ELITE licensing opportunity and was chosen as the licensee."

(4). I confirm that the explosives detector called the Easy Livermore Inspection Test for Explosives or ELITE has been licensed to Field Forensics Inc. I negotiated the license agreement between The Regents of the University of California and Field Forensics Inc. of St. Petersburg, Florida and am familiar with the technology licensed. One of the inventions licensed by the license agreement is Record of Invention IL-11088. The subject patent application IL-11088 is a patent application based upon Record of Invention IL-11088 and the subject patent application IL-11088 is one of the patent applications licensed to Field Forensics Inc. under the license agreement.

(5). I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

July 26, 2007

  
(Signature) Declarant: Catherine Elizondo

**Valley Times**  
**May 04, 2006**  
**Also appeared San Jose Mercury News**

**Area lab creates small, easy explosives-detection device**

**Livermore Laboratory's credit card-sized tool is in high demand from military, police officers**

*Betsy Mason*

**Lawrence Livermore Laboratory has made explosives detection easier with a new credit-card sized kit that is cheap, easy and works in just minutes.**

With terrorism fears running high since the Sept 11, 2001 terrorist attacks, detecting explosives is an even bigger priority for law enforcement and military personnel. Building on years of research with explosives detection in a laboratory setting, a team led by Livermore chemist John Reynolds grouped existing technology into a compact, stable package that could easily fit into the glove box of a police cruiser or a soldier's field pack.

The new detector is just two inches by three inches and slightly thicker than a credit card. Each kit will cost around \$25 and can generate results from one test in between one and four minutes.

The lab has licensed the technology to Field Forensics Inc. of St. Petersburg, Fla. On the market since October, customers include the U.S. Army and Canadian and Australian police. The company has pending orders from federal and state police agencies and from nuclear power plants.

"We have been talking with the airport authorities and they're quite interested in the technology," Reynolds said. "So I expect we'll see it in airports soon."

The new kit is as sensitive and reliable as the explosives-screening machines in major airports, but it is much less expensive and faster and easier to use.

The Lawrence Livermore team had military applications in mind when its members developed the kit. The ability to hunt down bomb makers in Iraq is critical to U.S. troops, they said.

"We think this will play an integral role," said Reynolds. "If you could catch them further up in the chain, like where the bombs are made, you'd actually be able to mitigate more attacks."

The kit can detect more than 30 different explosives. It contains a swipe that is used to wipe a suspect surface and then be re-inserted into the kit. A tiny glass vial full of chemicals is then broken inside the card, and if TNT is present, the swipe will change color. If there is no reaction, a second vial can be broken that will detect other types of explosives.

The new detector is called the Easy Livermore Inspection Test for Explosives, or ELITE.

The lab's researchers on the ELITE project were honored Wednesday night with a Federal Laboratory Consortium award for excellence in technology transfer that was presented during an awards ceremony in Minneapolis.

## Lawrence Livermore National Laboratory

### News Release

Contact: Steve Wampler  
Phone: (925) 423-3107  
E-mail: wampler1@llnl.gov

FOR IMMEDIATE RELEASE  
May 4, 2006  
NR-06-05-02

## Screening tool to help detect explosives nets technology transfer award for LLNL researchers

LIVERMORE, Calif. — Airport screeners, law enforcement and military personnel and others have a new ally in the war against terrorism – a portable, sensitive and accurate explosives detector developed by Lawrence Livermore National Laboratory researchers.

The new explosives detector, called the Easy Livermore Inspection Test for Explosives, or ELITE, is highly sensitive to more than 30 different explosives, making it one of the most effective explosive detection systems available, said John Reynolds, who led the technology's development and is the deputy director of LLNL's Forensic Science Center.

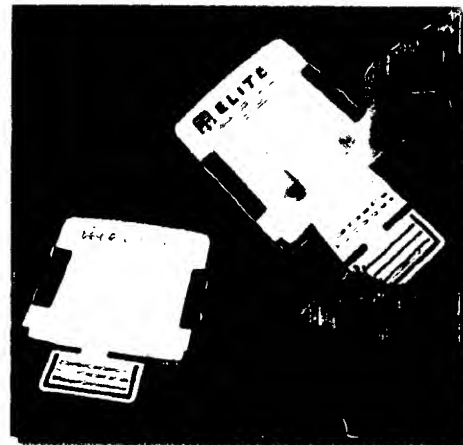
"Our goal is to develop new technology or take existing technology, make it better, and then adapt it for use in the field," Reynolds said.

Using the ELITE card, airport screeners, border patrol agents, security agents, first responders, police and military personnel and others can secure real-time analysis – within the space of one to four minutes – whether explosives are present, according to Reynolds.

The ELITE card was honored last night with a Federal Laboratory Consortium (FLC) award for excellence in technology transfer, presented to LLNL researchers during an awards dinner at the Minneapolis Marriott City Center.

The technology has been licensed to Field Forensics Inc., a St. Petersburg, Fla., company, and went on the market last October.

Already, the firm has picked up a host of customers, including the U.S. Army, the Royal Canadian Mounted Police, the Ontario Provincial Police, the Canada Air Marshals, the Queensland Police from Australia and others, said Field Forensics President Craig Johnson.



Jacqueline McBride/LLNL

The LLNL-developed ELITE explosives detector is designed for one-time use and can be disposed of as regular (non-hazardous) waste. Several of the devices can fit easily into a shirt pocket and can be used, for example, on vehicle door handles during routine traffic stops, on surfaces and door handles of suspicious parked vehicles, or on suspicious packages. The sample is tabbed for ease of handling and to allow recording of date, time, and sample location information.



Orders also are pending from several military agencies, federal and state police agencies and some commercial nuclear power plants, Johnson said.

"When it was announced that the ELITE explosives detection technology was going to be made available for licensing, we jumped at the opportunity," Johnson said. "ELITE technology is exactly that which our customers have been telling us they need: it's self-contained, small, light, disposable, easy to operate and inexpensive."

Reynolds echoes Johnson's points about the ELITE card's advantages, noting the technology is light (weighing a fraction of an ounce), small (the size of a 2-inch by 3-inch index card), inexpensive (costing less than \$25, substantially less in higher quantities) and stable (with a shelf life of about two years).

"It gives you a chance to detect explosives faster, cheaper and easier," Reynolds said. "That allows more law enforcement, military, airport security and others to have a better chance to catch the bad guys."

In Reynolds' view, the ELITE card could provide an important assist to the U.S. military in Iraq and on other fronts. "In Iraq, it could be used for finding bomb-makers, vehicles used to transport explosives or to find anyone in the chain of making improvised explosive devices.

"With great demand for travel in the industrial world, there is an increasing need for safe transportation within the United States and overseas," Reynolds said. "Significant issues involving explosives detection are cost, sensitivity and convenience. The ELITE detection alleviates all these concerns by providing a fast, reliable and convenient system that is easy to use."

To use the ELITE detection card, the suspect surface – whether hands, a vehicle or luggage – is wiped with a swipe. The swipe is replaced into the card and a small glass vial, or ampoule, is broken. If TNT-based explosive materials are present, the swipe will change color to indicate a positive reading. If the swab remains colorless and explosives are still suspected of being present, a second ampoule is broken, again looking for a color change that would indicate the presence of other types of explosives.

Development of the ELITE technology was achieved by a team of scientists from the Lab's Forensic Science Center, in partnership with LLNL's Energetic Materials Center, under research grants sponsored by the Department of Energy and the National Nuclear Security Administration. The work started in October 2003 and cost about \$1.5 million.

The Federal Laboratory Consortium for Technology Transfer (FLC) is a nationwide network of federal laboratories that provides the forum to develop strategies and opportunities for linking the laboratory mission technologies and expertise with the marketplace.

Organized in 1974 and formally chartered by the Federal Technology Transfer Act of 1986, the FLC consists of more than 700 major federal laboratories and centers and their parent departments and agencies.

Founded in 1952, Lawrence Livermore National Laboratory has a mission to ensure national security and to apply science and technology to the important issues of our time. Lawrence Livermore National Laboratory is managed by the University of California for the U.S. Department of Energy's National Nuclear Security Administration.

## SCIENCE NEWS

## New screening tool helps to detect explosives

By Stephen Wampler  
Newswatch staff writer

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JACQUELINE McBRIDE/NEWSLINE

Among the key developers of the ELITE explosive screening technology are (left to right): Del Eckels, John Reynolds and Peter Nunes, all of the Lab's Forensic Science Center. They are shown with some of the early ELITE prototypes and the current card version, which is resting in front on the table.

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In addition to Reynolds, members of the team who played important roles in the development of ELITE were: engineer Del Eckels, chemists Peter Nunes, Rich Whipple, Phil Pagoria, Marina Chiamppa-Zucca and Randy Simpson, who is also the director of the Lab's Energetic Materials Center.

"We tried many different materials for ELITE for compatibility and durability before we found the right combination," Eckels said. "Our ultimate aim was to make something as small, disposable, inexpensive and easy to use as possible."

In the process of developing ELITE, Eckels produced five generations of prototypes, with one of the last ones being a small metal instrument about the size of two butter cubes, before producing the ELITE card.

"We had to adapt the existing chemistry into a new configuration to meet the needs of ELITE — a long shelf life, sensitivity and compatibility with materials," Reynolds explained.

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## Lab technology commercialization success not just for ELITE

In addition to the Easy Livermore Inspection Test for Explosives (ELITE), scientists and engineers at the Lab's Forensic Science Center (FSC) have developed other technologies that have been licensed and commercialized.

One such technology is a portable Gas Chromatograph-Mass Spectrometer (GC-MS) unit that was licensed in 2002 to Constellation Technology, a firm located in the Tampa Bay area of Florida.

The portable unit performs the same functions as laboratory benchtop GC-MS equipment — but in a 70-pound, transportable package about the size of an ice chest.

"The advantage of this technology is that while GC-MS units are typically a laboratory analytical tool, we've essentially taken it from the laboratory into the field," said FSC chemist Peter Nunes, who oversees this technology transfer effort.

With a portable GC-MS unit, researchers do not have to transport a sample back to the laboratory, allowing analysis in the field and permitting a sample run to be completed in 20 to 30 minutes, Nunes said.

In the past, Livermore scientists have been deployed to

support the California National Guard with the portable GC-MS system at the 2003 World Series and the Democratic National Convention to provide rapid chemical analysis in case of any terrorist incidents.

The work to produce a portable GC-MS system was undertaken by engineers Del Eckels, Doug Howard and James Wong and three former FSC scientists who have retired.

Another FSC technology that has been licensed is a field-portable Solid Phase MicroExtraction (SPME), or chemical sponge, that was licensed to Field Forensics of St. Petersburg, Fla.

SPME is a chemical analysis technique that was previously limited to labs because of its fragility. LLNL scientists made the technology more robust, so it could be used in the field.

"SPME permits the absorption of volatile organic chemicals and allows them to be directly injected into a GC-MS system without any sample preparation, which is a real time-saver," Nunes said.

The capability of using SPME in the field was developed by Nunes, Fred Kelly and Brian Andresen, who has retired from LLNL.

—STEPHEN WAMPLER

## ON THE COVER

Once a swipe from a Lab-developed explosives screening technology is exposed to explosives, replaced in its card and a glass vial is popped, the swipe changes color to indicate the presence of explosives.



# **innovation:**

**AMERICA'S JOURNAL OF  
TECHNOLOGY COMMERCIALIZATION**

## **FLC's Tech Transfer Award Winners**

June/July 2006

More than 700 laboratories and research centers—representing almost all federal departments and agencies—conduct over \$100 billion in research and development annually and employ more than 100,000 scientists and engineers. The Awards for Excellence in Technology Transfer are presented each year to FLC member laboratories and their partners for successfully transferring federally developed technologies.

Following are those recognized at this year's conference held in May in Minneapolis.

### **Department of Agriculture**

#### **•Agricultural Research Service, Mid South Area**

Vaccines for the prevention of two major catfish diseases.

Summary: The modified live vaccine team demonstrated exceptional creativity in the invention and transfer of the first U.S. modified live vaccines that protect channel catfish from enteric septicemia and columnaris, two major diseases of U.S. farm raised catfish. Both diseases together cost the U.S. catfish industry \$50-70 million annually. The modified live vaccines are administered by bath immersion, a non-stressful and inexpensive process, to large numbers of young fish and provide life-long protection.

Team: Phillip H. Klesius, Joyce J. Evans and Craig A. Shoemaker

Transfer: Both vaccines (AQUAVAC-COLTM and AQUAVAC-ESCTM) were developed under a CRADA with Intervet, Inc., and exclusively licensed to Intervet.

#### **•Agricultural Research Service, South Atlantic Area**

A fertilizer alleviating nickel deficiencies.

Summary: The new Nickel Plus™ associated technology has cured significant plant disorders and diseases having a beneficial impact of millions of dollars. Additionally, evidence indicates improving nickel nutrition may also serve to improve environmental quality because it reduces the use of fungicides and nitrogen fertilizers for certain crops.

Team: Bruce W. Wood

Transfer: A cooperative interaction was initiated to jointly develop a commercial nickel fertilizer product (Nickel Plus™), and a new company (NIPAN, LLC) was formed. NIPAN, the co-owner of the patent, is negotiating an exclusive license to ARS' interest in the technology for correcting nickel deficiency in plants.

### **Department of Defense—Army**

#### **• Corps of Engineers, Engineer Research and Development Center, Construction Engineering Research Laboratory** Electro-Osmotic Pulse (EOP), for the control of moisture in below-grade concrete structures.

Summary: EOP eliminates moisture in below-grade structures, preventing the occurrence of mold, mildew, bacteria, corrosion, and standing water. It uses the concrete itself as the waterproofing agent by exploiting the fundamental

properties of electro-osmosis. EOP is better, faster and 40 percent less costly to install than conventional moisture control solutions.

Team: Orange S. Marshall, Michael K. McInerney, Sean Morefield and Vincent F. Hock

Transfer: In 2004, a new CRADA was implemented with industry partner, Drytronic. The parent company created the spin off, OsmoTech, to maximize EOP commercialization. The novel inter-relationship between the ERDC, Drytronic and its licensee OsmoTech has grown client application potential to include projects such as highway construction and tunnels.

- Edgewood Chemical Biological Center

Enzyme-based decontamination technology for organophosphorus nerve agents and pesticides.

Summary: This technology simplifies and improves the process of decontaminating a class of highly toxic chemicals, including nerve agents. The ECBC technology is non-toxic, non-corrosive, and environmentally safe. While initially intended for decontaminating equipment, facilities, and large areas, the enzymes could potentially be used in shower systems for decontaminating personnel and casualties.

Team: Joseph J. DeFrank, Tu-Chen Cheng, Vipin K. Rastogi and Christopher S. Penet

Transfer: Genencor International, Inc., agreed to license the technology and is now successfully producing the licensed enzymatic decontamination technology under the trademark DEFENZ™. Companies that produce and sell fire-fighting foams and sprays and other matrices are purchasing this product.

- Institute of Surgical Research

Special Medical Emergency Evacuation Device (SMEED).

Summary: A patent-protected metal framework that attaches to evacuation litters and holds individual pieces of medical equipment needed for optimal patient transport, lessening the discomfort of burn victims during medical transport. It eliminates the need to fasten uncomfortable equipment directly to patients and gives health care providers a clear view of any readout monitors on attached medical devices.

Team: Sgt. Eric Smeed (yes, that's Smeed!)

Transfer: The Army patented the device and in 2002 awarded a Small Business Innovation Research contract and exclusive license agreement to Impact Instrumentation Inc. of New Jersey. The company further developed the technology, manufacturing a commercial product now on the market.

## Department of Defense—Navy

- Naval Air Warfare Center Aircraft Division, Lakehurst

Liquid Atomizing Nozzle

Summary: A lightweight, non-clogging, inexpensive technology that does not require the extremely high operating pressures of standard fire suppression systems. It conserves water and minimizes consequential water damage and is a more environmentally safe method of fire suppression onboard aircraft. Smaller amounts of water can extinguish a fire more quickly, making it possible to carry water rather than environmentally harmful chemicals like halon, which is traditionally used in aircraft fire extinguishment systems.

Team: Joseph Wolfe

Transfer: Patented in 1996, the technology was transferred in 2001 via a partially exclusive license agreement to the aerospace supply company, International Aero Inc. of Burlington, Wash. The resulting commercial product, the Fine Water Mist System, awaits FAA approval for widespread aircraft use.

- Naval Air Warfare Center Aircraft Division, Patuxent River

Trivalent Chromium Processes (TCP).

Summary: A metal surface coating containing trivalent chromium sulfate that protects against corrosive environments, a significant improvement over the widely used, traditional but toxic hexavalent chromium process. The chemical solution minimizes corrosion of aluminum, zinc, and other substrates while it improves the bonding surface for paints.

Team: James L. Green, Michael J. Kane and Craig Matzdorf

Transfer: Under nonexclusive patent license agreements with several companies, the center has successfully transferred this important advance in metal finishing to widespread civilian use. Currently four licensees are in various stages of marketing TCP to consumers in the United States, Canada and Mexico.

•Naval Medical Center, San Diego

Treatment of noise-induced hearing loss through biologic mechanisms.

Summary: An orally administered antioxidant pharmaceutical product that will prevent, reduce, and in some cases even reverse acute noise-induced hearing loss. According to the Center for Disease Control, hearing loss costs the nation about \$56 billion a year.

Team: Richard Kopke and Michael Hoffer

Transfer: This technology has been successfully transferred to the private sector through an exclusive patent licensing agreement with American BioHealth Group (ABG). ABG has been on the fast track and one product based on this technology is already available to the public as a nonprescription nutraceutical known as “The Hearing Pill™.”

•Naval Undersea Warfare Center Division, Newport

Robust dimension reducing decision support tool for large, complex datasets.

Summary: The Data Extraction and Mining Software Tool (DEMIST) for large, complex data sets was developed and patented to support classification of targets for U.S. Navy sonar systems. DEMIST takes large, multi-dimensional datasets and reduces them dramatically in size to include only the relevant information needed for decision-making.

Team: Robert Lynch

Transfer: Under multiple CRADAs, DEMIST is being incorporated in software suites for credit scoring, consumer market targeting, chemical analysis, enterprise level risk management and decision support industries. Additional applications and licensing agreements are in process to apply DEMIST to problems associated with medical applications such as bioinformatics, pharmacogenomics and for homeland security-related data mining.

## Department of Defense—Air Force

•Air Force Research Laboratory, Directed Energy Directorate

Low emission, high current density field emission cold cathode.

Summary: This cold-cathode technology can deliver high electron current densities using very low power, therefore allowing the systems into which they're installed to operate at cool temperatures and be light in weight.

Team: Donald Shiffler

Transfer: The technology has been transferred to Fiore Industries, Albuquerque, through a licensing agreement. The technology has been further transferred to the private sector through CRADAs with companies that are developing X-ray tubes based on this cold cathode technology and has also been directly transferred through consultation and discussion to other federal labs, including Sandia National Laboratories.

•Air Force Research Laboratory, Human Effectiveness Directorate

The Attenuating Custom Communications Earpiece System (ACCES®)

Summary: The Attenuating Custom Communications Earpiece System (ACCES®), integrates specialized electronics and cabling into a custom-molded earplug that provides 40dB of mean noise reduction while providing clearly intelligible voice communication.

Team: John A. Hall

Transfer: Westone Laboratories, the tech transfer partner producing this state-of-the-art device, was recently awarded a General Services Administration contract. Even before gaining the GSA contract, ACCES had its inaugural commercial use in Spaceship One, the first private craft to fly more than 50 miles above the earth.

•Air Force Research Laboratory, Materials and Manufacturing Directorate  
Vascular Viewer™

Summary: A patent-protected viewing device that reveals blood vessels in the body under a broad range of lighting conditions. Medical personnel can use the invention to access blood vessels more quickly and accurately, even in extreme conditions such as on the battlefield or during trauma care.

Team: Robert Crane, Byron Edmonds, Walter Johnson and Charles Lovett

Transfer: The invention now is available as a commercial product—the Vascular Viewer—with impressive potential for saving lives, minimizing patient discomfort, and reducing health care costs. The Air Force awarded an exclusive license to a company to develop and market the technology, InfraRed Imaging Systems of Columbus, Ohio.

•Air Force Research Laboratory,  
Propulsion Directorate  
Silicon Carbide Schottky Diodes

Summary: This specialized semiconductor device is proven to reduce energy losses from conduction and switching, and for faster switching characteristics in high-speed electronic circuit applications.

Team: James Scofield

Transfer: In collaboration with Mississippi State University to incubate SemiSouth Laboratories under funding from the Ballistic Missile Defense Organization (now known as the Missile Defense Agency), this collaboration made Silicon Carbide fabrication practical for power devices. Also, a dual use science and technology agreement was implemented with manufacturer Cree, Inc., of Durham, N.C.

Department of Energy

•Argonne National Laboratory

Ultrananocrystalline Diamond (UNCD) coating technology for advanced multifunctional devices.

Summary: The coating technology captures many natural diamond properties in thin-film form and greatly surpasses other diamond film technologies with commercial potential.

Team: Orlando Auciellor and John A. Carlisle

Transfer: The UNCD thin-film technology was successfully transferred to an ANL-founded startup company, Advanced Diamond Technologies, Inc.

•Lawrence Livermore National Laboratory

ELITE: Easy Livermore Inspection Tester for Explosives

Summary: A disposable, portable, highly accurate explosives detector.

The ELITE detection card is highly sensitive to more than 30 explosives, making it one of the most effective detection systems available.

Team: John Reynolds, Ray Pierce, Peter Nunes, J. Del Eckels, Randall Simpson, Catherine Elizondo and Richard Whipple

Transfer: Field Forensics, Inc. responded to a Federal Business Opportunities announcement of the ELITE licensing opportunity and was chosen as the licensee.

•Los Alamos National Laboratory

PowerFactoRE—Reliability engineering toolkit for optimizing the manufacturing process.

Summary: A comprehensive approach to reducing operating costs and minimizing capital expenditures for manufacturing operations. PowerFactoRE enables manufacturers to predict, prevent, and reduce reliability losses, equipment failures, and repair downtime.

Team: Mike Hamada and Harry Martz

Transfer: Proctor & Gamble and LANL signed a CRADA to do reliability modeling using P&G data and Los Alamos expertise. Other manufacturers are realizing the same advantages P&G has enjoyed by licensing the PowerFactoRE toolkit from P&G and its marketing partners, BearingPoint and Zarpac, Inc.

•NNSA's Kansas City Plant

Improved method to separate and recover oil and plastic.

Summary: A new system for recycling plastic and oil that uses liquid and supercritical carbon dioxide to blast oil residue off of empty plastic motor oil bottles.

Team: George Bohnert, Thomas Hand, Gerald Woodburn, Edward Fuller, Charles Cook, Charles Long and Louis Mautino.

Transfer: The Kansas City Plant patented this process and licensed the technology to Itec Environmental Group, which used it to develop a plastics recycling system called the ECO2. Itec has been able to use this system to recycle not only motor oil bottles, but almost every other type of consumer plastic as well.

•Pacific Northwest National Laboratory

A breakthrough treatment for prostate cancer.

Summary: A powerful new brachytherapy seed that uses <sup>131</sup>Cs, which has a low-energy x-ray that effectively provides a cancer-killing dose to a tumor in a short period of time.

Team: Larry R. Greenwood, Donald Segna, Mark K. Murphy, Jaquetta R. DesChane, Lane A. Bray, Deborah S. Coffey, David Swanberg, Chuck Z. Soderquist, Clay L. O'Laughlin and Garrett Brown.

Transfer: IsoRay, which became a publicly owned company in July 2005, started the effort to produce the seeds commercially using PNNL's Radiochemical Processing Laboratory in 2004 under a current agreement with PNNL.

■

Improving medical care and saving lives with bioactive thin-film coatings.

Summary: A first-ever, water-based process that allows calcium-phosphate thin-film coatings containing controlled-release bioactive therapeutic agents to be deposited on orthopedic devices and other medical implants, such as catheters and stents. This technology will play a major role in dramatically reducing post-surgical infections in implant recipients and wounded military personnel, and will greatly increase acceptance of artificial joints by the body.

Team: Allison A. Campbell and Eric R. Jurrus

Transfer: The technology was licensed in 2004 by Bacterin, which recently joined forces with the Department of Defense, receiving a \$1.4 million appropriation to coat metal rods and pins with the technology for use in the battlefield. In addition, Bacterin has forged new relationships with three medical device manufacturers—Baxter International, C.R. Bard, and Cook—that have agreed to use the unique coating on their products.

■

Self-assembled monolayers on mesoporous silica (SAMMS) technology for mercury source reduction

Summary: A technology that quickly and easily reduces or removes mercury content without creating hazardous waste or by-products, and can be disposed of as a non-hazardous waste.

Team: Richard Skaggs, Glen E. Fryxell, Eric C. Lund, Shas V. Mattigod, Raymond S. Addleman, James J. Toth and Thomas S. Zemanian

Transfer: The technology has been presented to appropriate audiences and PNNL has developed relationships with industry partners, including Steward Advanced Materials, Chevron (formerly Unocal), Molycorp and PECO.

■

Starlight information visualization system

Summary: Starlight is the only software that can integrate many different data types and formats, perform high-speed, high-efficiency analysis, and display the results graphically so that the relationships among the data and their implications can be quickly and easily understood.



Team: John S. Risch, John Pinto, Michelle Hart, Dennis McQuerry, Brian Kriztstein, Scott Dowson and Wes Hatley.  
Transfer: Between 2000 and 2005, nearly 40 licenses were issued to enterprises ranging from government offices to academia, from small competitive intelligence companies to large companies such as Toyota and Proctor & Gamble.

- Sandia National Laboratories

Robust, wide-range hydrogen sensor

Summary: The sensor offers both low-range and high-range hydrogen measurement capability on the same chip, virtually eliminating false readings and making it an ideal candidate for a variety of government and commercial applications.

Team: Paul Smith, Robert Hughes, Michael Knoll, Jose L. Rodriguez and Wayne T. Corbett

Transfer: H2scan Corporation of Valencia, Calif., has licensed the technology and through a formal CRADA has developed a small in situ sensor with the capability of detecting hydrogen concentrations between 10 parts per million and 100 percent. H2scan has three retail products in commercial use and has delivered sensors to over 200 government and industry customers, including a classified DOE plant in Idaho Falls.

■

SMART: Sensor for measurement and analysis of radiation transients system

Summary: This system uses detectors and software to distinguish between normally occurring radioactive materials and those that are potential signatures of terrorist activities. The system operates in real time and indicates the level of confidence (low, fair, high) that the material has been correctly identified.

Team: Dean Mitchell, Jerry D. Strother, Peter E. Havey, Gene A. Kallenbach and Brent A. Burdick

Transfer: Sandia licensed its FitToDB and PASSBY software technology to Thermo Electron Corporation in 2003 and its GADRAS-LT software to Thermo Electron the following year. Under a CRADA signed in 2005, Sandia and Thermo Electron are also collaborating on refinement of the software for large-scale commercial deployments in Thermo Electron's advanced spectroscopic portal system.

■

SUMMiT V™ Fabrication Process and SAMPLEST™ Program

Summary: The Sandia Ultraplanar, Multilevel MEMS Technology (SUMMiT™) fabrication process is a MEMS batch fabrication process that uses conventional integrated circuit processing tools to achieve high volume, low cost MEMS production.

Team: Over 50 individuals.

Transfer: The SAMPLEST™ program, which enable customers to develop their own innovative MEMS-based products by leveraging advanced design, fabrication (utilizing the baseline SUMMiT IV™ and V™ technologies), has generated 49 Work for Others agreements and over 75 software licenses related to the SUMMiT™ fabrication processes.

Department of Health and Human Services

- National Cancer Institute, National Institutes of Health

Kepivance: Improving the quality of life for cancer patients.

Summary: This invention describes the use of Palifermin, a recombinant human keratinocyte growth factor (KGF) that can be used to reduce the incidence and duration of oral mucositis (painful sores and ulcers in the lining of the mouth) in cancer patients.

Team: Jeffrey S. Rubin, Paul W. Finch and Stuart A. Aaronson

Transfer: Amgen was chosen as a commercial partner to develop a useful therapeutic with this molecule because it had worked with other growth factors such as PDGF and G-CSF. Convinced that KGF would fit well in Amgen's product development strategy, NIH granted them an exclusive license to the invention in 1992. It was approved by



the FDA in 2004 and sold under the brand name Kepivance.

## NASA

John F. Kennedy Space Center

Emulsified zero-valent iron (EZVI)

Summary: A cost-effective technology for the in-situ treatment of dense non-aqueous phase liquids (DNAPL) source zone remediation and groundwater cleanup.

Team: Jacqueline W. Quinn, Debra R. Reinhart, Christian Clausen III and Cherie L. Geiger

Transfer: Kennedy Space Center signed five nonexclusive licenses with companies wanting to market and further develop EZVI.

•Marshall Space Flight Center

High-strength, wear-resistant aluminum alloy

Summary: Originally developed by NASA as a high-performance piston alloy to help meet U.S. automotive legislation requiring low-exhaust emission, the substance offers the dramatic increase in tensile strength at elevated temperatures (from 450 to 650 °F) needed for many applications.

Team: Po-Shou Chen, Jonathan Lee and Sammy Nabors

Transfer: The technology was recently used in Bombardier Recreational Products' Evinrude product line to meet the unique requirements of a direct-injected two-stroke outboard engine with world-class emissions levels. An ideal low-cost material for cast automotive components, the innovative alloy is enabling engine manufacturers to make engines that produce more horsepower at lighter weights that emit less pollutants.

For more information, see [www.federallabs.org](http://www.federallabs.org).

## Lawrence Livermore National Laboratory

### News Release

Contact: Steve Wampler  
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FOR IMMEDIATE RELEASE  
May 4, 2006  
NR-06-05-02

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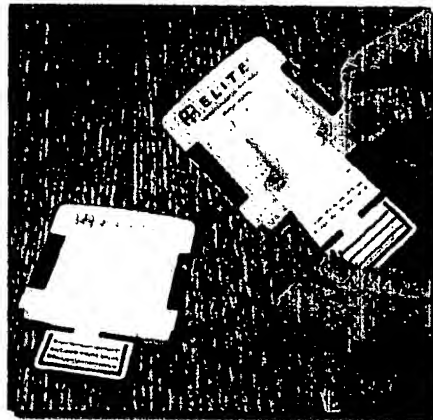
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Already, the firm has picked up a host of customers, including the U.S. Army, the Royal Canadian Mounted Police, the Ontario Provincial Police, the Canada Air Marshals, the Queensland Police from Australia and others, said Field Forensics President Craig Johnson.



Jacqueline McBride/LLNL

The LLNL-developed ELITE explosives detector is designed for one-time use and can be disposed of as regular (non-hazardous) waste. Several of the devices can fit easily into a shirt pocket and can be used, for example, on vehicle door handles during routine traffic stops, on surfaces and door handles of suspicious parked vehicles, or on suspicious packages. The sample is tabbed for ease of handling and to allow recording of date, time, and sample location information.

Orders also are pending from several military agencies, federal and state police agencies and some commercial nuclear power plants, Johnson said.

"When it was announced that the ELITE explosives detection technology was going to be made available for licensing, we jumped at the opportunity," Johnson said. "ELITE technology is exactly that which our customers have been telling us they need: it's self-contained, small, light, disposable, easy to operate and inexpensive."

Reynolds echoes Johnson's points about the ELITE card's advantages, noting the technology is light (weighing a fraction of an ounce), small (the size of a 2-inch by 3-inch index card), inexpensive (costing less than \$25, substantially less in higher quantities) and stable (with a shelf life of about two years).

"It gives you a chance to detect explosives faster, cheaper and easier," Reynolds said. "That allows more law enforcement, military, airport security and others to have a better chance to catch the bad guys."

In Reynolds' view, the ELITE card could provide an important assist to the U.S. military in Iraq and on other fronts. "In Iraq, it could be used for finding bomb-makers, vehicles used to transport explosives or to find anyone in the chain of making improvised explosive devices.

"With great demand for travel in the industrial world, there is an increasing need for safe transportation within the United States and overseas," Reynolds said. "Significant issues involving explosives detection are cost, sensitivity and convenience. The ELITE detection alleviates all these concerns by providing a fast, reliable and convenient system that is easy to use."

To use the ELITE detection card, the suspect surface – whether hands, a vehicle or luggage – is wiped with a swipe. The swipe is replaced into the card and a small glass vial, or ampoule, is broken. If TNT-based explosive materials are present, the swipe will change color to indicate a positive reading. If the swab remains colorless and explosives are still suspected of being present, a second ampoule is broken, again looking for a color change that would indicate the presence of other types of explosives.

Development of the ELITE technology was achieved by a team of scientists from the Lab's Forensic Science Center, in partnership with LLNL's Energetic Materials Center, under research grants sponsored by the Department of Energy and the National Nuclear Security Administration. The work started in October 2003 and cost about \$1.5 million.

The Federal Laboratory Consortium for Technology Transfer (FLC) is a nationwide network of federal laboratories that provides the forum to develop strategies and opportunities for linking the laboratory mission technologies and expertise with the marketplace.

Organized in 1974 and formally chartered by the Federal Technology Transfer Act of 1986, the FLC consists of more than 700 major federal laboratories and centers and their parent departments and agencies.

Founded in 1952, Lawrence Livermore National Laboratory has a mission to ensure national security and to apply science and technology to the important issues of our time. Lawrence Livermore National Laboratory is managed by the University of California for the U.S. Department of Energy's National Nuclear Security Administration.

**More Information:**

- LLNL's Public Affairs Office ([www.llnl.gov/pao/](http://www.llnl.gov/pao/))
- LLNL's Forensic Science Center (<http://www-cms.llnl.gov/about/fsc.html>)
- "Forensic Science Center Maximizes the Tiniest Clue"  
*Science & Technology Review*, April 2002 ([www.llnl.gov/str/April02/Andresen.html](http://www.llnl.gov/str/April02/Andresen.html))

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Lawrence Livermore National Laboratory  
7000 East Avenue • Livermore, CA 94550

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Administration

## SCIENCE NEWS

## New screening tool helps to detect explosives

By Stephen Wampler  
Newslines staff writer

Airport screeners, military personnel and others have a new ally in the war against terrorism — a portable, sensitive and accurate explosives detector developed by Lawrence Livermore National Laboratory researchers.

The new explosives detector, called the Easy Livermore Inspection Test for Explosives, or ELITE, is highly sensitive to more than 30 different explosives, making it one of the most effective explosive detection systems available, said John Reynolds, who led the technology's development and is the deputy director of LLNL's Forensic Science Center.

"Our goal is to develop new technology or take existing technology, make it better, and then adapt it for use in the field," Reynolds said.

Using the ELITE card, airport screeners, border patrol agents, security agents, first responders, military personnel and others can secure real-time analysis — within the space of one to four minutes — whether explosives are present, according to Reynolds.

The ELITE card was honored May 3 with a Federal Laboratory Consortium (FLC) award for excellence in technology transfer, which was presented to LLNL researchers during an awards dinner in Minneapolis.

The technology has been licensed to Field Forensics Inc., a St. Petersburg, Fla. company, and went on the market last October.

Already, the firm has picked up a host of customers, including the U.S. Army, the Royal Canadian Mounted Police, the Ontario Provincial Police, the Canada Air Marshals, the Queensland Police from Australia and others, said Field Forensics President Craig Johnson.

Orders also are pending from several military agencies, federal and state police agencies and some commercial nuclear power plants, Johnson said.

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JACQUELINE McBRIDE/NEWSLINES

Among the key developers of the ELITE explosive screening technology are (left to right): Del Eckels, John Reynolds and Peter Nunes, all of the Lab's Forensic Science Center. They are shown with some of the early ELITE prototypes and the current card version, which is resting in front on the table.

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In addition to Reynolds, members of the team who played important roles in the development of ELITE were: engineer Del Eckels, chemists Peter Nunes, Rich Whipple, Phil Pagoria, Marina Chiampapa-Zucca and Randy Simpson, who is also the director of the Lab's Energetic Materials Center.

"We tried many different materials for ELITE for compatibility and durability before we found the right combination," Eckels said. "Our ultimate aim was to make something as small, disposable, inexpensive and easy to use as possible."

In the process of developing ELITE, Eckels produced five generations of prototypes, with one of the last ones being a small metal instrument about the size of two butter cubes, before producing the ELITE card.

"We had to adapt the existing chemistry into a new configuration to meet the needs of ELITE — a long shelf life, sensitivity and compatibility with materials," Reynolds explained.

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## Lab technology commercialization success not just for ELITE

In addition to the Easy Livermore Inspection Test for Explosives (ELITE), scientists and engineers at the Lab's Forensic Science Center (FSC) have developed other technologies that have been licensed and commercialized.

One such technology is a portable Gas Chromatograph-Mass Spectrometer (GC-MS) unit that was licensed in 2002 to Constellation Technology, a firm located in the Tampa Bay area of Florida.

The portable unit performs the same functions as laboratory benchtop GC-MS equipment — but in a 70-pound, transportable package about the size of an ice chest.

"The advantage of this technology is that while GC-MS units are typically a laboratory analytical tool, we've essentially taken it from the laboratory into the field," said FSC chemist Peter Nunes, who oversees this technology transfer effort.

With a portable GC-MS unit, researchers do not have to transport a sample back to the laboratory, allowing analysis in the field and permitting a sample run to be completed in 20 to 30 minutes, Nunes said.

In the past, Livermore scientists have been deployed to

support the California National Guard with the portable GC-MS system at the 2003 World Series and the Democratic National Convention to provide rapid chemical analysis in case of any terrorist incidents.

The work to produce a portable GC-MS system was undertaken by engineers Del Eckels, Doug Howard and James Wong and three former FSC scientists who have retired.

Another FSC technology that has been licensed is a field-portable Solid Phase MicroExtraction (SPME), or chemical sponge, that was licensed to Field Forensics of St. Petersburg, Fla.

SPME is a chemical analysis technique that was previously limited to labs because of its fragility. LLNL scientists made the technology more robust, so it could be used in the field.

"SPME permits the absorption of volatile organic chemicals and allows them to be directly injected into a GC-MS system without any sample preparation, which is a real time-saver," Nunes said.

The capability of using SPME in the field was developed by Nunes, Fred Kelly and Brian Andresen, who has retired from LLNL.

— STEPHEN WAMPLER

## ON THE COVER:

Once a swipe from a Lab-developed explosives screening technology is exposed to explosives, replaced in its card and a glass vial is popped, the swipe changes color to indicate the presence of explosives.



# **innovation:**

**AMERICA'S JOURNAL OF  
TECHNOLOGY COMMERCIALIZATION**

## **FLC's Tech Transfer Award Winners**

June/July 2006

More than 700 laboratories and research centers—representing almost all federal departments and agencies—conduct over \$100 billion in research and development annually and employ more than 100,000 scientists and engineers. The Awards for Excellence in Technology Transfer are presented each year to FLC member laboratories and their partners for successfully transferring federally developed technologies.

Following are those recognized at this year's conference held in May in Minneapolis.

### **Department of Agriculture**

#### **•Agricultural Research Service, Mid South Area**

Vaccines for the prevention of two major catfish diseases.

Summary: The modified live vaccine team demonstrated exceptional creativity in the invention and transfer of the first U.S. modified live vaccines that protect channel catfish from enteric septicemia and columnaris, two major diseases of U.S. farm raised catfish. Both diseases together cost the U.S. catfish industry \$50-70 million annually. The modified live vaccines are administered by bath immersion, a non-stressful and inexpensive process, to large numbers of young fish and provide life-long protection.

Team: Phillip H. Klesius, Joyce J. Evans and Craig A. Shoemaker

Transfer: Both vaccines (AQUAVAC-COLTM and AQUAVAC-ESCTM) were developed under a CRADA with Intervet, Inc., and exclusively licensed to Intervet.

#### **•Agricultural Research Service, South Atlantic Area**

A fertilizer alleviating nickel deficiencies.

Summary: The new Nickel Plus™ associated technology has cured significant plant disorders and diseases having a beneficial impact of millions of dollars. Additionally, evidence indicates improving nickel nutrition may also serve to improve environmental quality because it reduces the use of fungicides and nitrogen fertilizers for certain crops.

Team: Bruce W. Wood

Transfer: A cooperative interaction was initiated to jointly develop a commercial nickel fertilizer product (Nickel Plus™), and a new company (NIPAN, LLC) was formed. NIPAN, the co-owner of the patent, is negotiating an exclusive license to ARS' interest in the technology for correcting nickel deficiency in plants.

### **Department of Defense—Army**

#### **• Corps of Engineers, Engineer Research and Development Center, Construction Engineering Research Laboratory** **Electro-Osmotic Pulse (EOP), for the control of moisture in below-grade concrete structures.**

Summary: EOP eliminates moisture in below-grade structures, preventing the occurrence of mold, mildew, bacteria, corrosion, and standing water. It uses the concrete itself as the waterproofing agent by exploiting the fundamental

properties of electro-osmosis. EOP is better, faster and 40 percent less costly to install than conventional moisture control solutions.

Team: Orange S. Marshall, Michael K. McInerney, Sean Morefield and Vincent F. Hock

Transfer: In 2004, a new CRADA was implemented with industry partner, Drytronic. The parent company created the spin off, OsmoTech, to maximize EOP commercialization. The novel inter-relationship between the ERDC, Drytronic and its licensee OsmoTech has grown client application potential to include projects such as highway construction and tunnels.

- Edgewood Chemical Biological Center

Enzyme-based decontamination technology for organophosphorus nerve agents and pesticides.

Summary: This technology simplifies and improves the process of decontaminating a class of highly toxic chemicals, including nerve agents. The ECBC technology is non-toxic, non-corrosive, and environmentally safe. While initially intended for decontaminating equipment, facilities, and large areas, the enzymes could potentially be used in shower systems for decontaminating personnel and casualties.

Team: Joseph J. DeFrank, Tu-Chen Cheng, Vipin K. Rastogi and Christopher S. Penet

Transfer: Genencor International, Inc., agreed to license the technology and is now successfully producing the licensed enzymatic decontamination technology under the trademark DEFENZ™. Companies that produce and sell fire-fighting foams and sprays and other matrices are purchasing this product.

- Institute of Surgical Research

Special Medical Emergency Evacuation Device (SMEED).

Summary: A patent-protected metal framework that attaches to evacuation litters and holds individual pieces of medical equipment needed for optimal patient transport, lessening the discomfort of burn victims during medical transport. It eliminates the need to fasten uncomfortable equipment directly to patients and gives health care providers a clear view of any readout monitors on attached medical devices.

Team: Sgt. Eric Smeed (yes, that's Smeed!)

Transfer: The Army patented the device and in 2002 awarded a Small Business Innovation Research contract and exclusive license agreement to Impact Instrumentation Inc. of New Jersey. The company further developed the technology, manufacturing a commercial product now on the market.

## Department of Defense—Navy

- Naval Air Warfare Center Aircraft Division, Lakehurst

Liquid Atomizing Nozzle

Summary: A lightweight, non-clogging, inexpensive technology that does not require the extremely high operating pressures of standard fire suppression systems. It conserves water and minimizes consequential water damage and is a more environmentally safe method of fire suppression onboard aircraft. Smaller amounts of water can extinguish a fire more quickly, making it possible to carry water rather than environmentally harmful chemicals like halon, which is traditionally used in aircraft fire extinguishment systems.

Team: Joseph Wolfe

Transfer: Patented in 1996, the technology was transferred in 2001 via a partially exclusive license agreement to the aerospace supply company, International Aero Inc. of Burlington, Wash. The resulting commercial product, the Fine Water Mist System, awaits FAA approval for widespread aircraft use.

- Naval Air Warfare Center Aircraft Division, Patuxent River

Trivalent Chromium Processes (TCP).

Summary: A metal surface coating containing trivalent chromium sulfate that protects against corrosive environments, a significant improvement over the widely used, traditional but toxic hexavalent chromium process. The chemical solution minimizes corrosion of aluminum, zinc, and other substrates while it improves the bonding surface for paints.

Team: James L. Green, Michael J. Kane and Craig Matzdorf

Transfer: Under nonexclusive patent license agreements with several companies, the center has successfully transferred this important advance in metal finishing to widespread civilian use. Currently four licensees are in various stages of marketing TCP to consumers in the United States, Canada and Mexico.

•Naval Medical Center, San Diego

Treatment of noise-induced hearing loss through biologic mechanisms.

Summary: An orally administered antioxidant pharmaceutical product that will prevent, reduce, and in some cases even reverse acute noise-induced hearing loss. According to the Center for Disease Control, hearing loss costs the nation about \$56 billion a year.

Team: Richard Kopke and Michael Hoffer

Transfer: This technology has been successfully transferred to the private sector through an exclusive patent licensing agreement with American BioHealth Group (ABG). ABG has been on the fast track and one product based on this technology is already available to the public as a nonprescription nutraceutical known as “The Hearing Pill™.”

•Naval Undersea Warfare Center Division, Newport

Robust dimension reducing decision support tool for large, complex datasets.

Summary: The Data Extraction and Mining Software Tool (DEMIST) for large, complex data sets was developed and patented to support classification of targets for U.S. Navy sonar systems. DEMIST takes large, multi-dimensional datasets and reduces them dramatically in size to include only the relevant information needed for decision-making.

Team: Robert Lynch

Transfer: Under multiple CRADAs, DEMIST is being incorporated in software suites for credit scoring, consumer market targeting, chemical analysis, enterprise level risk management and decision support industries. Additional applications and licensing agreements are in process to apply DEMIST to problems associated with medical applications such as bioinformatics, pharmacogenomics and for homeland security-related data mining.

## Department of Defense—Air Force

•Air Force Research Laboratory, Directed Energy Directorate

Low emission, high current density field emission cold cathode.

Summary: This cold-cathode technology can deliver high electron current densities using very low power, therefore allowing the systems into which they’re installed to operate at cool temperatures and be light in weight.

Team: Donald Shiffler

Transfer: The technology has been transferred to Fiore Industries, Albuquerque, through a licensing agreement. The technology has been further transferred to the private sector through CRADAs with companies that are developing X-ray tubes based on this cold cathode technology and has also been directly transferred through consultation and discussion to other federal labs, including Sandia National Laboratories.

•Air Force Research Laboratory, Human Effectiveness Directorate

The Attenuating Custom Communications Earpiece System (ACCES®)

Summary: The Attenuating Custom Communications Earpiece System (ACCES®), integrates specialized electronics and cabling into a custom-molded earplug that provides 40dB of mean noise reduction while providing clearly intelligible voice communication.

Team: John A. Hall

Transfer: Westone Laboratories, the tech transfer partner producing this state-of-the-art device, was recently awarded a General Services Administration contract. Even before gaining the GSA contract, ACCES had its inaugural commercial use in Spaceship One, the first private craft to fly more than 50 miles above the earth.



•Air Force Research Laboratory, Materials and Manufacturing Directorate

Vascular Viewer™

Summary: A patent-protected viewing device that reveals blood vessels in the body under a broad range of lighting conditions. Medical personnel can use the invention to access blood vessels more quickly and accurately, even in extreme conditions such as on the battlefield or during trauma care.

Team: Robert Crane, Byron Edmonds, Walter Johnson and Charles Lovett

Transfer: The invention now is available as a commercial product—the Vascular Viewer—with impressive potential for saving lives, minimizing patient discomfort, and reducing health care costs. The Air Force awarded an exclusive license to a company to develop and market the technology, InfraRed Imaging Systems of Columbus, Ohio.

•Air Force Research Laboratory,

Propulsion Directorate

Silicon Carbide Schottky Diodes

Summary: This specialized semiconductor device is proven to reduce energy losses from conduction and switching, and for faster switching characteristics in high-speed electronic circuit applications.

Team: James Scofield

Transfer: In collaboration with Mississippi State University to incubate SemiSouth Laboratories under funding from the Ballistic Missile Defense Organization (now known as the Missile Defense Agency), this collaboration made Silicon Carbide fabrication practical for power devices. Also, a dual use science and technology agreement was implemented with manufacturer Cree, Inc., of Durham, N.C.

Department of Energy

•Argonne National Laboratory

Ultrananocrystalline Diamond (UNCD) coating technology for advanced multifunctional devices.

Summary: The coating technology captures many natural diamond properties in thin-film form and greatly surpasses other diamond film technologies with commercial potential.

Team: Orlando Auciellor and John A. Carlisle

Transfer: The UNCD thin-film technology was successfully transferred to an ANL-founded startup company, Advanced Diamond Technologies, Inc.

•Lawrence Livermore National Laboratory

ELITE: Easy Livermore Inspection Tester for Explosives

Summary: A disposable, portable, highly accurate explosives detector.

The ELITE detection card is highly sensitive to more than 30 explosives, making it one of the most effective detection systems available.

Team: John Reynolds, Ray Pierce, Peter Nunes, J. Del Eckels, Randall Simpson, Catherine Elizondo and Richard Whipple

Transfer: Field Forensics, Inc. responded to a Federal Business Opportunities announcement of the ELITE licensing opportunity and was chosen as the licensee.

•Los Alamos National Laboratory

PowerFactoRE—Reliability engineering toolkit for optimizing the manufacturing process.

Summary: A comprehensive approach to reducing operating costs and minimizing capital expenditures for manufacturing operations. PowerFactoRE enables manufacturers to predict, prevent, and reduce reliability losses, equipment failures, and repair downtime.

Team: Mike Hamada and Harry Martz

Transfer: Proctor & Gamble and LANL signed a CRADA to do reliability modeling using P&G data and Los Alamos expertise. Other manufacturers are realizing the same advantages P&G has enjoyed by licensing the PowerFactoRE toolkit from P&G and its marketing partners, BearingPoint and Zarpac, Inc.

•NNSA's Kansas City Plant

Improved method to separate and recover oil and plastic.

Summary: A new system for recycling plastic and oil that uses liquid and supercritical carbon dioxide to blast oil residue off of empty plastic motor oil bottles.

Team: George Bohnert, Thomas Hand, Gerald Woodburn, Edward Fuller, Charles Cook, Charles Long and Louis Mautino.

Transfer: The Kansas City Plant patented this process and licensed the technology to Itec Environmental Group, which used it to develop a plastics recycling system called the ECO2. Itec has been able to use this system to recycle not only motor oil bottles, but almost every other type of consumer plastic as well.

•Pacific Northwest National Laboratory

A breakthrough treatment for prostate cancer.

Summary: A powerful new brachytherapy seed that uses  $^{131}\text{Cs}$ , which has a low-energy x-ray that effectively provides a cancer-killing dose to a tumor in a short period of time.

Team: Larry R. Greenwood, Donald Segna, Mark K. Murphy, Jaquetta R. DesChane, Lane A. Bray, Deborah S. Coffey, David Swanberg, Chuck Z. Soderquist, Clay L. O'Laughlin and Garrett Brown.

Transfer: IsoRay, which became a publicly owned company in July 2005, started the effort to produce the seeds commercially using PNNL's Radiochemical Processing Laboratory in 2004 under a current agreement with PNNL.

■

Improving medical care and saving lives with bioactive thin-film coatings.

Summary: A first-ever, water-based process that allows calcium-phosphate thin-film coatings containing controlled-release bioactive therapeutic agents to be deposited on orthopedic devices and other medical implants, such as catheters and stents. This technology will play a major role in dramatically reducing post-surgical infections in implant recipients and wounded military personnel, and will greatly increase acceptance of artificial joints by the body.

Team: Allison A. Campbell and Eric R. Jurrus

Transfer: The technology was licensed in 2004 by Bacterin, which recently joined forces with the Department of Defense, receiving a \$1.4 million appropriation to coat metal rods and pins with the technology for use in the battlefield. In addition, Bacterin has forged new relationships with three medical device manufacturers—Baxter International, C.R. Bard, and Cook—that have agreed to use the unique coating on their products.

■

Self-assembled monolayers on mesoporous silica (SAMMS) technology for mercury source reduction

Summary: A technology that quickly and easily reduces or removes mercury content without creating hazardous waste or by-products, and can be disposed of as a non-hazardous waste.

Team: Richard Skaggs, Glen E. Fryxell, Eric C. Lund, Shas V. Mattigod, Raymond S. Addleman, James J. Toth and Thomas S. Zemanian

Transfer: The technology has been presented to appropriate audiences and PNNL has developed relationships with industry partners, including Steward Advanced Materials, Chevron (formerly Unocal), Molycorp and PECO.

■

Starlight information visualization system

Summary: Starlight is the only software that can integrate many different data types and formats, perform high-speed, high-efficiency analysis, and display the results graphically so that the relationships among the data and their implications can be quickly and easily understood.

Team: John S. Risch, John Pinto, Michelle Hart, Dennis McQuerry, Brian Kriztstein, Scott Dowson and Wes Hatley.  
Transfer: Between 2000 and 2005, nearly 40 licenses were issued to enterprises ranging from government offices to academia, from small competitive intelligence companies to large companies such as Toyota and Proctor & Gamble.

•Sandia National Laboratories

Robust, wide-range hydrogen sensor

Summary: The sensor offers both low-range and high-range hydrogen measurement capability on the same chip, virtually eliminating false readings and making it an ideal candidate for a variety of government and commercial applications.

Team: Paul Smith, Robert Hughes, Michael Knoll, Jose L. Rodriguez and Wayne T. Corbett

Transfer: H2scan Corporation of Valencia, Calif., has licensed the technology and through a formal CRADA has developed a small in situ sensor with the capability of detecting hydrogen concentrations between 10 parts per million and 100 percent. H2scan has three retail products in commercial use and has delivered sensors to over 200 government and industry customers, including a classified DOE plant in Idaho Falls.

■

SMART: Sensor for measurement and analysis of radiation transients system

Summary: This system uses detectors and software to distinguish between normally occurring radioactive materials and those that are potential signatures of terrorist activities. The system operates in real time and indicates the level of confidence (low, fair, high) that the material has been correctly identified.

Team: Dean Mitchell, Jerry D. Strother, Peter E. Havey, Gene A. Kallenbach and Brent A. Burdick

Transfer: Sandia licensed its FitToDB and PASSBY software technology to Thermo Electron Corporation in 2003 and its GADRAS-LT software to Thermo Electron the following year. Under a CRADA signed in 2005, Sandia and Thermo Electron are also collaborating on refinement of the software for large-scale commercial deployments in Thermo Electron's advanced spectroscopic portal system.

■

SUMMiT V™ Fabrication Process and SAMPLES™ Program

Summary: The Sandia Ultraplanar, Multilevel MEMS Technology (SUMMiT™) fabrication process is a MEMS batch fabrication process that uses conventional integrated circuit processing tools to achieve high volume, low cost MEMS production.

Team: Over 50 individuals.

Transfer: The SAMPLES™ program, which enable customers to develop their own innovative MEMS-based products by leveraging advanced design, fabrication (utilizing the baseline SUMMiT IV™ and V™ technologies), has generated 49 Work for Others agreements and over 75 software licenses related to the SUMMiT™ fabrication processes.

Department of Health and Human Services

• National Cancer Institute, National Institutes of Health

Kepivance: Improving the quality of life for cancer patients.

Summary: This invention describes the use of Palifermin, a recombinant human keratinocyte growth factor (KGF) that can be used to reduce the incidence and duration of oral mucositis (painful sores and ulcers in the lining of the mouth) in cancer patients.

Team: Jeffrey S. Rubin, Paul W. Finch and Stuart A. Aaronson

Transfer: Amgen was chosen as a commercial partner to develop a useful therapeutic with this molecule because it had worked with other growth factors such as PDGF and G-CSF. Convinced that KGF would fit well in Amgen's product development strategy, NIH granted them an exclusive license to the invention in 1992. It was approved by

the FDA in 2004 and sold under the brand name Kepivance.

## NASA

John F. Kennedy Space Center

Emulsified zero-valent iron (EZVI)

Summary: A cost-effective technology for the in-situ treatment of dense non-aqueous phase liquids (DNAPL) source zone remediation and groundwater cleanup.

Team: Jacqueline W. Quinn, Debra R. Reinhart, Christian Clausen III and Cherie L. Geiger

Transfer: Kennedy Space Center signed five nonexclusive licenses with companies wanting to market and further develop EZVI.

•Marshall Space Flight Center

High-strength, wear-resistant aluminum alloy

Summary: Originally developed by NASA as a high-performance piston alloy to help meet U.S. automotive legislation requiring low-exhaust emission, the substance offers the dramatic increase in tensile strength at elevated temperatures (from 450 to 650 °F) needed for many applications.

Team: Po-Shou Chen, Jonathan Lee and Sammy Nabors

Transfer: The technology was recently used in Bombardier Recreational Products' Evinrude product line to meet the unique requirements of a direct-injected two-stroke outboard engine with world-class emissions levels. An ideal low-cost material for cast automotive components, the innovative alloy is enabling engine manufacturers to make engines that produce more horsepower at lighter weights that emit less pollutants.

For more information, see [www.federallabs.org](http://www.federallabs.org).

# POCKET-SIZED TEST DETECTS

**S**ECURITY forces throughout the world need detection tools that can quickly and accurately locate small amounts of explosives. Technology developed by Lawrence Livermore will provide emergency response, law-enforcement, and military personnel

with an easy-to-use explosives detector small enough to carry in a shirt pocket. This technology, called E.L.I.T.E.<sup>TM</sup> (Easy Livermore Inspection Test for Explosives), is inexpensive and requires minimal training for deployment.

E.L.I.T.E. cards are particularly useful for screening vehicles, containers, and people for explosives residue. The 5- by 7.5-centimeter card weighs about an ounce, and test results are available immediately in the field. After a card has been used, it can be discarded without special handling.

The E.L.I.T.E. card technology was developed by a team of scientists and engineers from the Laboratory's Forensic Science Center (FSC) and Center for Energetic Materials. Led by FSC deputy director John Reynolds, the team won a 2006 R&D 100 Award for the new technology. The product, which also received a 2006 Excellence in Technology Transfer Award from the Federal Laboratory Consortium, is marketed by Field Forensics, Inc., of Florida. Since October 2005, when units became commercially available, Field Forensics has sold E.L.I.T.E. cards to many government agencies, including the Department of Homeland Security, New York State Police, Royal Canadian Mounted Police, and Queensland (Australia) Police.



The E.L.I.T.E.<sup>TM</sup> card is small enough to fit in a pocket, yet sensitive enough to detect trace amounts of up to 30 explosives.

Livermore members of the E.L.I.T.E.<sup>TM</sup> development team (from left to right): Randall Simpson, John Reynolds, J. Del Eckels, and Pete Nunes.



Lawrence Livermore National Laboratory

# TRACE EXPLOSIVES

## Inexpensive Cards with Built-In Simplicity

Each E.L.I.T.E. card is good for one test. To collect a sample, a user removes the swipe from the card, rubs it on a suspect area—a shoe, car door, or suitcase—and slides it back into the card. The user then ruptures two sealed ampoules that contain the developing chemicals. A few drops of the reagent flow onto the swipe through microchannels fabricated in the card's plastic case. Within a minute, an explosive trace, if present, will appear as a brightly colored spot on the white swipe.

The color and intensity of the spot indicate the type and concentration of the explosive found. Explosives generally show up as bright red or pink, so they are easy to distinguish from dirt and other stray substances. The chemical formulation used in E.L.I.T.E. cards can detect military and commercial explosives, such as C-4, Semtex, TNT, and derivatives, as well as inorganic explosives and propellants, such as ammonium nitrate and black powder. A used card requires no special handling and can be disposed of as regular waste.

The cost of detection technology is a critical issue for many security organizations, and E.L.I.T.E. delivers an affordable product. Cards cost \$10 to \$20 each; other commercially available screening systems can range from \$40 to \$7,500. But cost is not the only advantage. "We developed a reagent formulation with a dramatically improved shelf life," says Reynolds. "E.L.I.T.E. units have a much longer service life than comparable products." Similar screening products have an average shelf life of one year or less.

Once in service, these detection tools remain effective for one to four months. The E.L.I.T.E. reagents, however, have an indefinite shelf life and do not have to be replaced frequently.

The E.L.I.T.E. card also has lower detection limits than other screening products and can detect more than

30 types of explosives and propellants. In addition, reagents are self-contained in each card, so users are never exposed to these chemicals. Other detection technologies typically store reagents in separate bottles, and users must spray the formula onto a swipe or otherwise apply it by hand. This approach not only exposes users to chemicals but also can be difficult to use in inclement weather.

Reynolds notes that other explosives detection kits can be cumbersome or require users to follow complicated procedures. "The E.L.I.T.E. card solves this problem, too," he says. "Instructions are printed right on the card, so user error is largely eliminated. Plus the engineered design dispenses the proper amount of chemicals each time."

## Potential to Save Lives

E.L.I.T.E. cards operate effectively in harsh environments, so the technology could be adapted for military use, such as to screen materials in combat zones. Other applications include border inspections, airport and transit security, and decontamination verification.

The cards' potential to stem terrorism is also clear. "Explosives will continue to be a terrorist's weapon of choice as long as they are available in a usable form," says Reynolds. "E.L.I.T.E. cards provide security personnel with a fast, effective method to detect explosives and deter their use. These sensitive, robust explosives detectors offer an enormous potential for saving the lives of civilians and military and law-enforcement personnel."

—Ann Parker

**Key Words:** Easy Livermore Inspection Test for Explosives (E.L.I.T.E.™) card, explosives testing, R&D 100 Award.

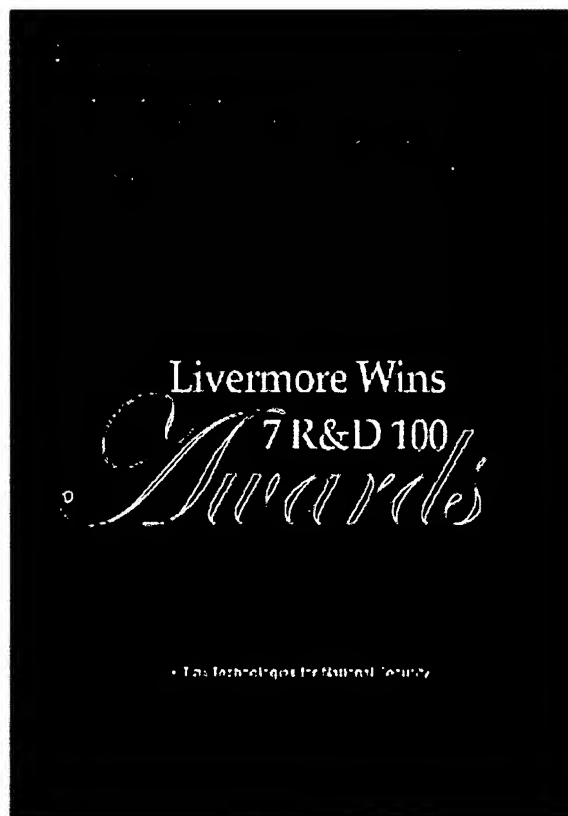
**For further information contact John Reynolds (925) 422-6028 (reynolds3@llnl.gov).**



Lawrence Livermore National Laboratory

## About the Cover

Laboratory researchers captured seven R&D 100 awards in *R&D Magazine's* annual competition for the top 100 industrial innovations worldwide. Highlights beginning on p. 4 describe the award-winning technologies: a pocket-sized explosives detector, a highly precise radiation detector, an airborne wide-area surveillance system, an improved wavelength converter for high-average-power lasers, data-mining software, an application to provide programming language interoperability, and an interferometer that improves the search for distant planets. Since 1978, Livermore researchers have received 113 R&D 100 awards. The R&D 100 logo on p. 1 is reprinted courtesy of *R&D Magazine*.



Cover design: Amy Henke

# Explosives Detection

## The Three Sectors of Society That Rely on Explosives Detection

Category: [Explosives Detection](#) — kevindark @ 7:25 pm

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After an explosion one does not need an expert to conduct explosives detection. For security personnel, however, the real trick is finding a way to detect an explosives device before its detonation leads to injuries or fatalities. Three different sectors have had reason to hire large numbers of security personnel. Three different sectors of society have reason to purchase equipment for explosives detection. The following article takes a closer look at the nature of the security needs in those three sectors. It also mentions how new and improved detection devices can alleviate the threat posed by many types of dangers.

Explosives, such as those in firecrackers, have been around for quite some time. The need for detection of those who possess such explosives has recently created an entire new industry. The equipment produced by manufacturers within that industry has been purchased by groups in three different sectors of modern-day society.

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Those involved with transportation security represent one group that has come to rely on explosives detection. At one time detection of explosives relied exclusively on the use of metal detectors. Present-day suicide bombers, however, have forced those in transportation security to look beyond the ability to detect metallic devices. Present-day explosives detection must be able to pick-up those who have non-metallic devices on their person.

One device that can do just that is the Sentinel II, a device used at portals in airports. The Sentinel II causes a flow of air to pass over each passenger. The air removes any loose explosives particles from the skin or clothing. The sample obtained from each passenger needs to be analyzed for explosives.

The members of the military occupy the second sector of society that has come to rely on explosives detection. The manufacturers of the detection devices for the military have focused their efforts on the miniaturization of existing devices. They have now developed collective protection alarms that are easy to move from place to place. Such alarms offer added protection to military vehicles, small boats with military personnel and command bunkers.

The third sector of society that has started to use explosives detection contains the persons involved with facilities security. This represents a large sector, one with many possible targets for explosive devices. Some of the facilities can be described as vital utilities. Water treatment plants and electrical generators powered by nuclear reactors are two such vital utilities. Sports centers and shopping malls are also facilities that have been mentioned as "soft targets" for explosives experts.

At all of those facilities the security personnel have three major concerns. One concern focuses on possible contamination in the heating, ventilation or air conditioning systems. A second concern considers the possible contamination of the water supply. The third concern brings-up the need for explosives detection. That is the fear that someone could plant a bomb inside of any such facility.

The above information has failed to mention one further possible treat to the occupants in any facility. It is also a threat that could disrupt the functioning of a transportation system. That unmentioned threat received much media attention in the mid 1990's. At that time, a terrorist released a toxic gas into a Japanese subway.

Hopefully the latest developments in explosives detection will lead to the development of ways to deter a repeat of such a frightening action.



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## **HomelandDefenseStocks.com Reports: As Terrorist Attacks Continue, Need for Explosives Detection System Technology Surges**

Market Wire, July, 2005

www.HomelandDefenseStocks.com (HDS) an investor news portal for the homeland defense and security sector, reports on the need for explosives detection system technologies as threats of terrorist attacks continue. Companies working towards bomb detection technology include L-3 Communications Security and Detection Systems, Inc. (NYSE: LLL), the world's leading supplier of X-ray security screening systems; Markland Technologies (OTC BB: MRKL) a defense and homeland security company transforming advanced laboratory technology into real-world products such as next-generation electronic imaging and other detection solutions; Sniffex (OTC: SNFX) manufacturer of a pocket-sized, hand held explosives detection device; and Law Enforcement Associates Corporation (OTC BB: LENF), a manufacturer of a diverse line of undercover surveillance and detection products.

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## **ELITE Forensic Explosive Material Detection Device for Law Enforcement, Commercial, Military, Airline and Homeland Security**

**Field Forensics Inc. (FFI)** manufactures innovative and reliable, disposable explosives and gun shot residue detection kits. FFI also manufactures SPME (Solid Phase Micro-Extraction) technology products for field sampling and lab analysis of explosives, drugs, accelerants, and toxins.

**FFI** is dedicated to producing practical and robust detection devices for use in homeland security and law enforcement.

**E.L.I.T.E.™** is a new technology for explosives and gun shot residue detection manufactured and distributed internationally by **FFI**.

**E.L.I.T.E.™ Model EL100** is a simple, quick, and cost-effective, explosives detection kit. **E.L.I.T.E.™ Model EL100** detects PETN, RDX, and HMX, ammonium nitrate and more than forty other compounds used in commercial, military, and improvised explosives.

### **E.L.I.T.E.™ Model EL100 Explosive Detection Kit**

Quick – results in 90 seconds or less

Simple – designed for use by non-specialists

Tough – long life in extreme environmental conditions

Sensitive – up to 10,000% more sensitive than other kits

Field-tested and effective, **E.L.I.T.E.** is currently in use with many military, law enforcement, homeland security and commercial security groups.

**E.L.I.T.E.™ Model EL100** is the winner of the R&D 100 Award for 2006 and is also a winner of the US Federal Laboratory Consortium's



**R & D 100  
AWARD WINNER  
2006**

Excellence in Technology Transfer Award.

**FFI** has offices and agents worldwide including the United States, Canada, Hong Kong, Singapore, Japan, Australia, Egypt, United Arab Emirates, Saudi Arabia, the United Kingdom, Spain, Scandinavia and South America.

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## **Explosive Detection Device for Commercial Protection, Military Security and Homeland Defense**

### **Affordable, Effective, Reliable, Ultra-Portable & Disposable**

For several years Field Forensics, Inc. (FFI), in response to the demands of its commercial security, homeland defense and military clients, had been searching for the explosives detection technology that could be universally deployed in the fight against terrorism.

In response to these demands, FFI recently introduced the E.L.I.T.E.<sup>™</sup>, Model EL100, Explosives Detection Kit. Developed in cooperation with one of the USA's top national research laboratories, the EL100 finally allows a pocket-sized, disposable, low-cost, reliable, robust, and easy-to-use explosives detection device. Field Forensics, Inc. has now made E.L.I.T.E.<sup>™</sup> Technology commercially available. The EL100 exceeds existing kits in:

- 1.Detection Capability:** detects 50% more types of explosives
- 2.Sensitivity:** is up to 10,000% more sensitive
- 3.Reliability:** has at least twice the shelf life of many existing kits
- 4.Ease of Use:** there are no bottles or vials – it is NOT a miniature chemistry lab



**R & D 100**  
**AWARD WINNER**  
**2006**

**The explosives detection process with the E.L.I.T.E.<sup>™</sup> is quick:**

**Step 1. Remove swab**



**Step 2. Rub surface**



**Step 3. Re-insert swab**



**Step 4. Snap 'A'**



**Step 5. High-color result**



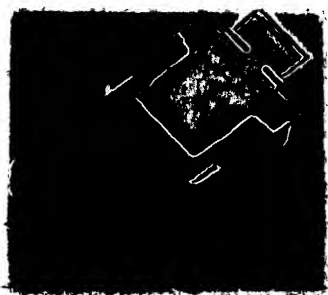
While sensing instruments such as "sniffers" and other devices have their place, they are simply too expensive, too cumbersome, and sometimes too unreliable to be fielded in significant numbers. Also, since many explosives do not have much of a vapor signature, sniffers will have limited utility in detecting them.

The E.L.I.T.E.™ EL100 reliably detects the presence of explosives and propellants. It is self-contained, with only a small optional heating system such as a butane lighter or battery-powered heater. To collect a sample, the EL100 swab is rubbed on the suspect area, object or person and then placed back into the card for testing. Two sealed ampoules containing very small amounts of chemicals are ruptured in a specific order. These chemicals create a very visible color change in the presence of a broad range of military, commercial and inorganic explosives and propellants. The entire test takes less than 90 seconds.

**Some examples of positives for TNT, Tetryl, 2,6 DNT, RDX and ANFO (left to right):**



The EL100 detects dozens of explosives – military, commercial, and those made by would-be terrorists.



#### **Model EL100-BPH**

**Battery Powered Heater** – portable heating device for EL100. The portable heater operates on NIMH rechargeable batteries and is designed to operate for an eight-hour shift of normal, intermittent usage. It extends the range of the EL100 and improves sensitivity.



#### **Model EL100-BLH**

**Heating Jig** – the heating jig is designed for use with an open flame such as a cigarette lighter of some sort. The jig folds on itself for easy storage. It extends the range of the EL100 and improves sensitivity.



### **Model EL101 Field Kit**

**Field Kit** – hard-sided field kit includes ten EL100 kits, one each EL100-BPH and EL100-BLH, EL100-FG Field Guide (weatherproof).



### **Model EL102 Field Kit**

**Field Kit** – soft-sided field kit includes ten EL100 kits, one each EL100-BPH and EL100-BLH, EL100-FG Field Guide (weatherproof).

E.L.I.T.E.™ Is made in the USA. Patents Pending.

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